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VERIFIED TRANSLATION OF PRIORITY DOCUMENT

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Application No.	Country	Date Filed
10-18013	Japan	January 14, 1998

The undersigned declares further that all statements made herein of his/her own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Applicant(s): Victor Company of Japan, Ltd.

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【Title of the Invention】 DIGITAL DISC, ENCODING APPARATUS FOR AUDIO SIGNAL, AND DECODING APPARATUS

【Number of Claims】 20

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10-18013

[DOCUMENT NAME] Specification

[TITLE OF THE INVENTION] Digital Disc, Encoding Apparatus for Audio Signal, and Decoding Apparatus

[CLAIMS]

[Claim 1] A digital disc on which a data structure is recorded, the data structure having:

an audio area on which a digital audio signal is recorded, the digital audio signal being that an analog audio signal is sampled at a certain sampling frequency, and is quantized with a certain quantization bit number for each of multiple channels; and

a quantization control information area loaded with a quantization bit number for each of the channels of the digital audio signal recorded on the previously-mentioned audio area.

[Claim 2] The digital disc mentioned in claim 1, wherein the previously-mentioned audio area is loaded with digital audio signals which are that analog audio signals are quantized with quantization bit numbers different for a front channel and a rear channel of multiple channels; and

wherein the previously-mentioned quantization control information area is loaded with the quantization bit numbers for the front channel and the rear channel recorded on the previously-mentioned audio area.

[Claim 3] A digital disc on which a data structure is recorded, the data structure having:

an audio area on which a digital audio signal is recorded, the digital audio signal being that an analog audio signal is sampled at a

certain sampling frequency, and is quantized with a certain quantization bit number for each of multiple channels; and

a quantization control information area loaded with a sampling frequency for each of the channels of the digital audio signal recorded on the previously-mentioned area.

[Claim 4] The digital disc mentioned in claim 3, wherein the previously-mentioned audio area is loaded with digital audio signals which are that analog audio signals are sampled at sampling frequencies different for a front channel and a rear channel of multiple channels, and are quantized; and

wherein the previously-mentioned quantization control information area is loaded with the sampling frequencies for the front channel and the rear channel recorded on the previously-mentioned audio area.

[Claim 5] The digital disc mentioned in claim 3, wherein the front channel and the rear channel of the multiple channels of the analog audio signals are sampled at a same sampling frequency and are quantized, and the rear channel is thinned out before being recorded on the previously-mentioned audio area; and

wherein the previously-mentioned quantization control information area is loaded with the sampling frequency for the front channel and the rear channel recorded on the previously-mentioned audio area, and thinning control information for the rear channel.

[Claim 6] The digital disc mentioned in claim 3, wherein the low frequency effect channel of the multiple channels of the analog audio signals is sampled at the same sampling frequency as that for the other

channels and is quantized, and the low frequency effect channel is thinned out before being recorded on the previously-mentioned audio area; and

wherein the previously-mentioned quantization control information area is loaded with the sampling frequency for the low frequency effect channel and the other channels recorded on the previously-mentioned audio area, and thinning control information for the low frequency effect channel.

[Claim 7] A digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area.

[Claim 8] A digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a channel in a first group and a channel in a second group of multiple channels; and

a quantization control information area loaded with the sampling

frequencies and the quantization bit numbers for the channel in the first group and the channel in the second group of the digital audio signals recorded on the previously-mentioned audio area, and an assignment of the channel of the first group and the channel of the second group.

[Claim 9] The digital disc mentioned in any one of claims 1 to 8, characterized in that:

the previously-mentioned audio area is further loaded with digital audio signals of stereophonic two channels which are sampled at a sampling frequency equal to or different from that of the previously-mentioned multiple channels; and

the previously-mentioned quantization control information area is further loaded with the sampling frequency of the digital audio signals of the two channels which are recorded on the previously-mentioned audio area.

[Claim 10] The digital disc mentioned in any one of claims 1 to 9, characterized in that:

the previously-mentioned audio area is further loaded with digital audio signals of stereophonic two channels which are quantized with a quantization bit number equal to or different from that of the previously-mentioned multiple channels; and

the previously-mentioned quantization control information area is further loaded with the quantization bit number of the digital audio signals of the two channels which are recorded on the previously-mentioned audio area.

[Claim 11] The digital disc mentioned in claim 9 or 10, characterized

in that the digital audio signals of the previously-mentioned multiple channels and the digital audio signals of the stereophonic two channels are recorded on different areas of the disc respectively.

[Claim 12] The digital disc mentioned in any one of claims 1 to 11, characterized in that the digital audio signals of the previously-mentioned multiple channels or the digital audio signals of the stereophonic two channels are encoded according to AC-3 or MPEG-1/2.

[Claim 13] An encoding apparatus for an audio signal which has means for formatting into a data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized with quantization bit numbers different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area.

[Claim 14] An encoding apparatus for an audio signal which has means for formatting into a data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the sampling frequencies for the front channel and the rear channel of the digital

audio signals recorded on the previously-mentioned audio area.

[Claim 15] An encoding apparatus for an audio signal which has means for formatting into a data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area.

[Claim 16] An encoding apparatus for an audio signal which has means for formatting into a data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a channel in a first group and a channel in a second group of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the channel in the first group and the channel in the second group of the digital audio signals recorded on the previously-mentioned audio area, and an assignment of the channel of the first group and the channel of the second group.

[Claim 17] A decoding apparatus for an audio signal which decodes a digital disc on which a data structure is recorded, the data structure

having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized with quantization bit numbers different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area;

the apparatus having means for decoding the digital audio signals of the front channel and the rear channel which are recorded on the previously-mentioned audio area on the basis of the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned quantization control information area.

[Claim 18] A decoding apparatus for an audio signal which decodes a digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the sampling frequencies for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area;

the apparatus having means for decoding the digital audio signals

of the front channel and the rear channel which are recorded on the previously-mentioned audio area on the basis of the sampling frequencies for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned quantization control information area.

[Claim 19] A decoding apparatus for an audio signal which decodes a digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area;

the apparatus having means for decoding the digital audio signals of the front channel and the rear channel which are recorded on the previously-mentioned audio area on the basis of the sampling frequencies and the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned quantization control information area.

[Claim 20] A decoding apparatus for an audio signal which decodes a digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the

digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a channel in a first group and a channel in a second group of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the channel in the first group and the channel in the second group of the digital audio signals recorded on the previously-mentioned audio area, and an assignment of the channel of the first group and the channel of the second group;

the apparatus having means for decoding the digital audio signals of the channel in the first group and the channel in the second group which are recorded on the previously-mentioned audio area on the basis of the assignment of the channel in the first group and the channel in the second group, and the sampling frequencies and the quantization bit numbers for the channel in the first group and the channel in the second group of the digital audio signals recorded on the previously-mentioned quantization control information area.

[DETAILED EXPLANATION OF THE INVENTION]

[0001]

[Field of the Invention]

This invention relates to a digital disc, an encoding apparatus for an audio signal, and a decoding apparatus. This invention particularly relates to a data structure of a disc typified by a DVD audio disc.

[0002]

[Prior Art]

A CD (compact disc) is known as a prior-art optical disc for audio playback. A DVD (digital video disc) is known as an optical disc which is higher in density than a CD. However, in the DVD (referred to as the DVD-video hereinafter), since the recording is done while a video signal is set main while an audio signal is set sub, there are the following problems.

(1) The audio signal is integral with the video signal, and a recording capacity for the audio signal is small.

(2) It is difficult to manage time for the audio signal.

(3) It is difficult to take out simple character information such as a tune name.

[0003]

Users of audio are wider in layer of methods of use than video, and an area of TOC (table of contents) is provided as in a CD and thereby an easy playback method is desired. However, in the DVD-video, since a navigation control pack (a CONT pack), plural video (V) packs, and audio (A) packs compose a video contents block unit, and the reproduction of the V and A packs is controlled by the CONT pack, there is the following problem. If an audio signal is intended to be mainly recorded, it is difficult for a user to implement playback. Thus, it is inconvenient in use.

[0004]

Furthermore, in the DVD-video, since the time management is implemented only in video frame units, there is the following problem. If an audio signal is intended to be mainly recorded, the continuity of the audio signal is more important than video and hence it is difficult to

manage real time.

[0005]

A conceivable DVD audio disc can be easily played back by a user if an audio signal is mainly recorded, and it is convenient in use. In order to facilitate the management of real time, the conceivable DVD audio disc is provided with a control pack containing information for managing audio data with respect to packs containing the audio data.

[0006]

[Problems to be Solved by the Invention]

In the case where an audio signal is recorded on such a DVD audio disc, since it is an optical disc higher in density than a CD, it is possible that an audio signal having a long time is recorded as stereophonic signals of left and right two channels and also multiple channel signals of 5 channels, 6 channels, or 8 channels. If a sound recording person side can implement the recording of sound while changing the channel number, the sampling frequency, and the quantization bit number in accordance with a disc, an album, or a tune, or can implement the recording of sound while changing the sampling frequency depending on a channel and narrowing a band depending on a channel, it is possible to provide a DVD audio disc having a desired recording time and DVD audio discs of various types which have different recording times and different tone qualities. Here, compatibility needs to be present among such various DVD audio discs so that they can be played back by a player of one kind.

[0007]

Accordingly, an object of this invention is to provide a digital disc

which enables a sound recording person side to change the tone quality and the recording time of an audio signal, which can implement the recording for approximately a constant recording time, and which can be played back by a player of one kind even if the recording time and the tone quality of a recorded audio signal are different.

[0008]

[Means for Solving the Problems]

In order to attain the above-mentioned object, this invention is designed so that a sound recording person side can arbitrarily select the sampling frequency and the quantization bit number of a digital audio signal of each of multiple channels, and the digital audio signal of each channel and the quantization bit number and the sampling frequency thereof are recorded on a DVD audio disc, and that a DVD audio disc player side can implement D/A conversion of the digital audio signal of each channel on the basis of the quantization bit number and the sampling frequency.

[0009]

This invention provides a digital disc on which a data structure is recorded, the data structure having:

an audio area on which a digital audio signal is recorded, the digital audio signal being that an analog audio signal is sampled at a certain sampling frequency, and is quantized with a certain quantization bit number for each of multiple channels; and

a quantization control information area loaded with a quantization bit number for each of the channels of the digital audio signal recorded on the previously-mentioned audio area.

[0010]

This invention provides a digital disc on which a data structure is recorded, the data structure having:

an audio area on which a digital audio signal is recorded, the digital audio signal being that an analog audio signal is sampled at a certain sampling frequency, and is quantized with a certain quantization bit number for each of multiple channels; and

a quantization control information area loaded with a sampling frequency for each of the channels of the digital audio signal recorded on the previously-mentioned area.

[0011]

This invention provides a digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area.

[0012]

This invention provides a digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at

sampling frequencies and quantization bit numbers different for a channel in a first group and a channel in a second group of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the channel in the first group and the channel in the second group of the digital audio signals recorded on the previously-mentioned audio area, and an assignment of the channel of the first group and the channel of the second group.

[0013]

This invention provides an encoding apparatus for an audio signal which has means for formatting into a data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized with quantization bit numbers different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area.

[0014]

This invention provides an encoding apparatus for an audio signal which has means for formatting into a data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies different for a front channel and a rear channel of

multiple channels; and

a quantization control information area loaded with the sampling frequencies for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area.

[0015]

This invention provides an encoding apparatus for an audio signal which has means for formatting into a data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area.

[0016]

This invention provides an encoding apparatus for an audio signal which has means for formatting into a data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a channel in a first group and a channel in a second group of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the channel in the first group and the channel in the second group of the digital audio

signals recorded on the previously-mentioned audio area, and an assignment of the channel of the first group and the channel of the second group.

[0017]

This invention provides a decoding apparatus for an audio signal which decodes a digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized with quantization bit numbers different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area;

the apparatus having means for decoding the digital audio signals of the front channel and the rear channel which are recorded on the previously-mentioned audio area on the basis of the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned quantization control information area.

[0018]

This invention provides a decoding apparatus for an audio signal which decodes a digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the

digital audio signals being that analog audio signals are quantized at sampling frequencies different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the sampling frequencies for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area;

the apparatus having means for decoding the digital audio signals of the front channel and the rear channel which are recorded on the previously-mentioned audio area on the basis of the sampling frequencies for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned quantization control information area.

[0019]

This invention provides a decoding apparatus for an audio signal which decodes a digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a front channel and a rear channel of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned audio area;

the apparatus having means for decoding the digital audio signals of the front channel and the rear channel which are recorded on the

previously-mentioned audio area on the basis of the sampling frequencies and the quantization bit numbers for the front channel and the rear channel of the digital audio signals recorded on the previously-mentioned quantization control information area.

[0020]

This invention provides a decoding apparatus for an audio signal which decodes a digital disc on which a data structure is recorded, the data structure having:

an audio area on which digital audio signals are recorded, the digital audio signals being that analog audio signals are quantized at sampling frequencies and quantization bit numbers different for a channel in a first group and a channel in a second group of multiple channels; and

a quantization control information area loaded with the sampling frequencies and the quantization bit numbers for the channel in the first group and the channel in the second group of the digital audio signals recorded on the previously-mentioned audio area, and an assignment of the channel of the first group and the channel of the second group;

the apparatus having means for decoding the digital audio signals of the channel in the first group and the channel in the second group which are recorded on the previously-mentioned audio area on the basis of the assignment of the channel in the first group and the channel in the second group, and the sampling frequencies and the quantization bit numbers for the channel in the first group and the channel in the second group of the digital audio signals recorded on the previously-

mentioned quantization control information area.

[0021]

[Embodiments of the Invention]

Embodiments of this invention will be explained below with reference to drawings. Fig. 1 is an explanation view showing one embodiment of the format of a DVD-video and the format of a DVD-audio related to this invention. Fig. 2 is an explanation view which shows, in detail, the format of an audio manager (AMG) in Fig. 1. Fig. 3 is an explanation view which shows, in detail, the format of an audio title set (ATS) in Fig. 1. Fig. 4 is an explanation view which shows, in detail, the format of an audio manager information (AMGI) in Fig. 2. Fig. 5 is an explanation view which shows, in detail, the format of an audio title set attribute table (ATS-ATRT) in Fig. 4. Fig. 6 is an explanation view which shows, in detail, the format of audio title set attribute data (ATS-ATR) in Fig. 5. Fig. 7 is an explanation view which shows, in detail, the format of audio title set information (ATSI) in Fig. 3. Fig. 8 is an explanation view which shows, in detail, the format of an audio title set information management table (ATSI-MAT) in Fig. 7. Fig. 9 is an explanation view which shows, in detail, audio title set menu audio stream attribute data (ATSM-AST-ATR) in Fig. 8. Fig. 10 is an explanation view which shows, in detail, the format of an audio title set audio stream attribute table (ATS-AST-ATRT) in Fig. 8. Fig. 11 is an explanation view which shows, in detail, attribute data (ATS-AST-ATR) of each audio stream in Fig. 10.

[0022]

Fig. 12 is an explanation view which shows an audio contents block unit (ACBU) in Fig. 1. Fig. 13 is an explanation view which shows,

in detail, the format of a video pack and an audio pack in Fig. 12. Fig. 14 is an explanation view which shows, in detail, the format of an audio control (A-CONT) pack in Fig. 12. Fig. 15 is an explanation view which shows, in detail, the format of an audio character display (ACD) area in Fig. 12. Fig. 16 is an explanation view which shows an example displayed by name space information in Fig. 15. Fig. 17 is an explanation view which shows, in detail, the format of an audio search data (ASD) area in Fig. 14. Fig. 18 is an explanation view showing a modified example of an audio contents block unit in Fig. 12.

[0023]

Here, both a signal of stereophonic two channels and a signal of multiple channels being 5/6/8 channels are recorded on a DVD-audio disc, which is explained, as audio signals in correspondence with a period of transition from a CD generation to a DVD-audio generation. It is thought that after the period of transition, only a signal of multiple channels being 5/6/8 channels will be recorded.

[0024]

Figs. 1(a) and (b) show the formats of a DVD-video and a DVD-audio respectively. Although the format of a DVD-audio has different area names, compatibility with a DVD-video is provided. Firstly, the format of a DVD-video is roughly formed by areas of a video manager (VMG) at a head, and a plurality of video title sets (VTS) following it. In correspondence therewith, the format of a DVD-audio is formed by areas of an audio manager (AMG) which is shown in detail in Fig. 2, and a plurality of audio title sets (ATS) following the AMG as shown in detail in Fig. 3.

[0025]

Each of the VTS is composed of VTS information (VTSI) at a head, one or more video contents block sets (VCBS) following it, and VTSI at an end. In correspondence therewith, each of the ATS is composed of ATS information (ATSI) at a head, one or more audio contents block sets (ACBS) following it, and ATSI at an end. The playing times of respective tunes in the ACBS are set in the ATSI in real time.

In this invention, menu information for indicating a menu picture is recorded on the first ACBS. This is similar to that in a DVD video, and an explanation thereof will be omitted.

[0026]

Each of the VCBS is composed of a plurality of VCB. On the other hand, each of the ACBS is composed of a plurality of ACB. Each of the VCB corresponds to one title (Title) of video. In correspondence therewith, each of the ACB corresponds one title of audio. Each (one title) of the VCB is composed of a plurality of chapters (Chapter). On the other hand, in correspondence therewith, each (one title) of the ACB is composed of a plurality of tracks (Track). The chapter contains a part of title (PTT). The track contains a part of title (PTT).

[0027]

Each of the chapters is composed of a plurality of cells (CELL). On the other hand, in correspondence therewith, each of the tracks is composed of a plurality of indexes (Index). Each of the cells is composed of a plurality of VCB units (VCBU). On the other hand, in correspondence therewith, each of the indexes is composed of a

plurality of ACB units (ACBU). Each of the VCB units and the ACB units is composed of a plurality of packs. One pack has 2048 bytes.

[0028]

Each of the VCB units is composed of a control pack (referred to as a CONT pack hereinafter) at a head, a plurality of video (V) packs, audio (A) packs, and sub picture (SP) packs following it. On the other hand, in correspondence therewith, each of the ACB units is composed of an audio control pack (referred to as an A-CONT pack hereinafter) at a head, and a plurality of A packs and V packs following it.

[0029]

A CONT pack is loaded with information for controlling later V packs. An A-CONT pack is loaded with information for managing an audio signal of later A packs as TOC information of a CD. An A pack is loaded with audio data. A V pack is loaded with video data and also, for example, closed caption (CC) data other than audio data.

[0030]

As shown in Fig. 2, the AMG (audio manager) has audio manager information (AMGI) which is shown in detail in Fig. 4, an audio contents block sets (AMGM-ACBS) for an AMG menu, and AMGI for back-up. The AMGM-ACBS has presentation control information (PCI) and data search information (DSI) as control information.

[0031]

As shown in Fig. 3, the ATS (audio title set) has audio title set information (ATSI) which is shown in detail in Fig. 7, an audio contents block set (ATSM-ACBS) for an ATS menu, an audio contents block set (ATSA-ACBS) for an ATS title, and ATSI for back-up. Each of the ATSM-

ACBS and the ATSA-ACBS has PCI and DSI which are previously mentioned (Fig. 2).

[0032]

As shown in detail in Fig. 4, the AMGI (audio manager information) has an AMGI management table (AMGI-MAT), a title search pointer table (T-SRPT), an audio manager menu PGCI unit table (AMGM-PGCI-UT), a parental management information table (PTL-MAIT), an audio title set attribute table (ATS-ATRT) in detail in Fig. 5, a text manager (TXTDT-MG), an audio manager menu cell (index) address table (AMGM-C-ADT), and an audio manager menu audio contents block unit address map (AMGM-ACBU-ADMAP).

[0033]

As shown in detail in Fig. 5, the ATS-ATRT (audio title set attribute table) has audio title set attribute table information (ATS-ATRTI), audio title set attribute search pointers (ATS-ATR-SRP#1 ~ #n) of respective plural (n) ATS, and audio title set attribute data (ATS-ATR-#1 ~ #n) of respective plural (n) ATS such as shown in detail in Fig. 6.

[0034]

As shown in detail in Fig. 6, each of the audio title set attribute data (ATS-ATR-#1 ~ #n) has ATS-ATR-EA (end address), ATS-CAT (category), and ATS-ATRI (information).

[0035]

As shown in detail in Fig. 7, the ATSI (ATS information) shown in Fig. 3 has an audio title set information management table (ATSI-MAT) shown in detail in Fig. 8, an audio title set part of title search pointer table (ATS-PTT-SRPT), an audio title set program chain information

table (ATS-PGCIT), an audio title set menu PGCI unit table (ATSM-PGCI-UT), an audio title set time map table (ATS-TMAPT), an audio title set menu cell address table (ATSM-C-ADT), an audio title set menu audio contents block unit address map (ATSM-ACBU-ADMAP), an audio title set cell address table (ATS-C-ADT), and an audio title set audio contents block unit address map (ATS-ACBU-ADMAP).

[0036]

As shown in detail in Fig. 8, the ATSI-MAT (audio title set information management table) shown in Fig. 7 has ATS-ID (identifier), ATS-EA (end address), ATSI-EA, VERN (DVD audio specification version number), ATS-CAT (category), ATSI-MAT-EA, ATSM-ACBS-SA (start address), ATSA-ACBS-SA, ATS-PTA-SRPT-SA, ATS-PGCIT-SA, ATSM-PGCI-UT-SA, ATS-TMAP-SA, ATSM-C-ADT-SA, ATSM-ACBU-ADMAP-SA, ATSM-AST-ATR (ATSM audio stream attribute) such as shown in detail in Fig. 9, ATS-AST-Ns (ATS audio stream number), and ATS-AST-ATRT (ATS audio stream attribute table) such as shown in detail in Fig. 10.

[0037]

As shown in detail in Fig. 9, the ATSM-AST-ATR has 8 bytes (bits b63 ~ b0), and is loaded with the following data (1) ~ (4) as an attribute of a coded audio signal recorded on the present disc (other bits are reserved).

(1) Audio encoding mode (3 bits b63 ~ b61)

000b: Dolby AC-3

010b: MPEG-1 or MPEG-2 (absence of an extended bit stream)

011b: MPEG-2 (presence of an extended bit stream)

100b: linear PCM audio

101b: linear PCM audio (containing 2 ch + 5 ch, 2 ch + 6 ch, 2 ch + 8 ch)

[0038]

(2) Quantization/DRC (dynamic range control) information (2 bits b55 and b54)

In the case where the audio encoding mode is "000b", "11b";

In the case where the audio encoding mode is "010b" or "011b":

00b: dynamic range control data is absent from the MPEG audio stream;

01b: dynamic range control data is present in the MEG audio stream;

10b, 11b: reserved;

In the case where the audio encoding mode is "100b" or "101b", with respect to stereophonic 2 channels:

00b: 16 bits

01b: 20 bits

10b: 24 bits

11b: reserved

[0039]

(3) Sampling frequency fs (2 bits b53 and b52)

With respect to stereophonic 2 channels:

00b: 48 kHz

01b: 96 kHz

10b: 192 kHz

(4) Audio channel number (3 bits b50 ~ b48)

000b: 1 ch (monaural)

001b: 2 ch (stereophonic)

010b: 3 ch

011b: 4 ch

100b: (stereophonic 2 ch + 5 ch)

101b: (stereophonic 2 ch + 6 ch)

110b: 7 ch

111b: (stereophonic 2 ch + 8 ch)

[0040]

As shown in detail in Fig. 11, the ATS-AST-ATRT (ATS audio stream attribute table) shown in Fig. 10 has ATS-AST-ATR for each of the audio streams #0 ~ #7. Each of the ATS-AST-ATR has 8 bytes (64 bytes in total).

[0041]

As shown in Fig. 11, the ATS-AST-ATR for one audio stream has 8 bytes (bit b63 ~ b0) similarly to the audio title set menu audio stream attribute data (ATSM-AST-ATR) shown in Fig. 9. In addition to the above-mentioned attribute data (1) ~ (4), it has:

(5) a multi-channel extension (ME) (1 bit b60);

(6) an audio type (2 bits b59 and b58);

(7) an audio application mode (2 bits b57 and b56);

(8) stream (AST) thinning information (2 bits b47 and b46); and

(9) thinning information (2 bits b45 and b44) for only an LFE (Low Frequency Effect) 1 channel. On the (7) audio application mode of the present DVD audio disc, 11b: 2 ch + surround mode is recorded. In addition, on both the (8) stream thinning information and the (9) LEF 1 ch thinning information, as band information, the following is recorded.

00b: full (1/1)

01b: half (1/2)

10b: quarter (1/4)

[0042]

The (4) audio channel number in the ATSM-AST-ATR is always 2 ch in the case of the audio stream #0. The audio stream #1 contains front 3 channels. Specifically, for example, in the case where an audio signal of one title is recorded with 2 + 6 ch, 2 ch stereophonic signals are assigned to the audio stream #0, and front signals of 3 ch among 6 ch are assigned to the audio stream #1, and rear signals of 2 ch and an LFE 1 ch signal are assigned to the audio stream #2. On both the audio manager information management table (AMGI-MAT) shown in Fig. 4 and the audio title set information management table (ATSI-MAT) shown in Fig. 8, "3" is recorded as use data of the streams #0 ~ #2.

[0043]

For example, the 2 + 6 ch analog audio signal is sampled at the following sampling frequency fs, and is quantized with the following quantization bit number before being recorded:

stereophonic 2 ch: 48 kHz, 20 bits

front 3 ch: 96 kHz, 16 bits

rear 2 ch, LFE 1 ch: 48 kHz, 16 bits (absence of thinning). In this case, on the audio title set menu audio stream attribute data (ATSM-AST-ATR) shown in Fig. 9, as an attribute of stereophonic 2 ch, the following are recorded:

(1) audio encoding mode

101b: linear PCM audio (containing 2 ch + 5 ch, 2 ch + 6 ch, 2 ch + 8 ch);

(2) quantization/DRC

01b: 20 bits;

(3) sampling frequency fs

00b: 48 kHz;

(4) audio channel number

101b: (stereophonic 2 ch + 6 ch).

[0044]

On the ATS-AST-ATR of the audio stream #0, the following are recorded:

(1) audio encoding mode

101b: linear PCM audio (containing 2 ch + 5 ch, 2 ch + 6 ch, 2 ch + 8 ch);

(2) quantization/DRC

01b: 20 bits;

(3) sampling frequency fs

00b: 48 kHz;

(4) audio channel number

001b: 2 ch (stereophonic);

(7) audio application mode

11b: 2 ch + surround mode;

(8) thinning information of the stream

00b: full (1/1); and

(9) LFE 1 ch thinning information

00b: full (1/1).

[0045]

On the ATS-AST-ATR of the audio stream #1, the following are recorded:

(1) audio encoding mode

101b: linear PCM audio (containing 2 ch + 5 ch, 2 ch + 6 ch, 2 ch + 8 ch);

(2) quantization/DRC

00b: 16 bits;

(3) sampling frequency fs

01b: 96 kHz;

(4) audio channel number

010b: 3 ch;

(7) audio application mode

11b: 2 ch + surround mode;

(8) thinning information of the stream

00b: full (1/1); and

(9) LFE 1 ch thinning information

00b: full (1/1).

[0046]

On the ATS-AST-ATR of the audio stream #2, the following are recorded:

(1) audio encoding mode

101b: linear PCM audio (containing 2 ch + 5 ch, 2 ch + 6 ch, 2 ch + 8 ch);

(2) quantization/DRC

00b: 16 bits;

(3) sampling frequency fs

00b: 48 kHz;

(4) audio channel number

010b: 3 ch;

(7) audio application mode

11b: 2 ch + surround mode;

(8) thinning information of the stream

00b: full (1/1); and

(9) LFE 1 ch thinning information

00b: full (1/1).

[0047]

Next, an explanation will be given of an A pack on which an audio stream is recorded, and a control pack therefor. As shown in Fig. 12, a VCB unit is composed of an arbitrary number of packs corresponding to 0.4 ~ 1.0 second. An ACB unit is composed of an arbitrary number of packs corresponding to 0.5 ~ 1.0 second. An A-CONT pack in an ACB unit of a DVD-audio is placed in a third pack in a VCB unit of a DVD-video.

[0048]

Basically, A-CONT packs are placed in units of 0.5 second in audio time, and are placed so that they are complete in a range of 0.5 ~ 1.0 second at the region between indexes. Audio time (GOF: Group of Audio Frame unit) is denoted by an A-CONT pack, and its data position is determined by the audio frame number, the first access unit pointer, and the frame header number. It is not mandatory that an A pack immediately preceding an A-CONT pack is padded in units of 0.5 second in audio time.

[0049]

Neighboring A packs are arranged so that audio signals will relate

to each other. For example, in the case of stereophony, an L channel pack and an R channel pack are arranged to be adjacent to each other. In the case of multiple channels being 5/6/8 channels, there are arranged to be adjacent to each other. In the case where an image is displayed during playback, a V pack is placed to be adjacent to an A pack thereof. As shown in Fig. 13, an A pack and a V pack are designed so that pack headers of 14 bytes in total which are pack start information of 4 bytes, SCR (System Clock Reference: system clock reference value) information of 6 bytes, Mux rate information of 3 bytes, and stuffing of 1 byte are added to user data (A data, V data) of 2034 bytes (1 pack = 2048 bytes in total). In this case, the SCR information being a time stamp is set to "1" in a head pack within an ACB unit, and is made continuous in a same title, and thereby time of an A pack in the same title can be managed.

[0050]

On the other hand, as shown in Fig. 14, an A-CONT pack is composed of a pack header of 14 bytes, a system header of 24 bytes, an ACD (audio character display) packet of 1003 bytes, and an ASD (audio search data) packet of 1007 bytes. The ACD packet is composed of a packet header of 6 bytes, sub stream ID of 1 byte, ACD (audio character display) information of 636 bytes such as shown in detail in Fig. 15, and a reserved area of 360 bytes. Similarly, the ASD packet is composed of a packet header of 6 bytes, sub stream ID of 1 byte, and ASD (audio search data) of 1000 bytes such as shown in detail in Fig. 17.

[0051]

As shown in detail in Fig. 15, the ACD information area of 636

bytes is composed of a general information area of 48 bytes, and areas of 294 bytes for a character "1" of first language and a character "2" of second language respectively. Each of these areas is composed of a name space area of 93 bytes, two free space areas each of 93 bytes, and a data pointer area of 15 bytes. Data for indicating, for example, a tune name such as shown in Fig. 16 is placed in one of the name space areas for the character "1" of the first language and the character "2" of the second language, and data for implementing indication in English is placed in the other name space area. The indication languages may be decided by a disc publisher.

[0052]

The general information of 48 bytes is composed of, for example, service level information of 16 bytes, language code information of 12 bytes, character set code information of 6 bytes, display item information of 6 bytes, 2-byte information of difference from previous ACD information, and reserved information of 6 bytes. The service level information of 16 bytes represents a display size, a type of indication, a discrimination among audio/video/SP, a stream, and others. Characters are mandatory. A bit map is optional. The language code information of 12 bytes represents the languages of the characters "1" and "2" each by 2 bytes similarly to a video file, and denotes 8 languages at most in one file. English is mandatory.

[0053]

The character set code information of 6 bytes can have 15 character codes at most which correspond to language codes, and is designed so that 1 byte represents the presence or absence of the

languages of the characters "1" and "2", and the type thereof. Code examples are shown below.

1. ISO646
2. ISO8859-1
3. MS-JIS

The display item information of 6 bytes represents free spaces "1" and "2" which are shown in Fig. 15, the presence and absence of a data pointer, and ID. The name space is mandatory. The title name, the music name, and the artist name are always written.

[0054]

As shown in detail in Fig. 17, the ASD (audio search data) of 1000 bytes is composed of general information of 16 bytes, current number (No.) information of 8 bytes, present time information of 16 bytes, title set search information of 8 bytes, title search information of 8 bytes, track search information of 404 bytes, index search information of 408 bytes, highlight search information of 80 bytes, and a reserved area of 52 bytes.

[0055]

The current number information of 8 bytes is composed of a present title number (2 bytes: BCD) of the title set, a present track number (2 bytes: BCD) of the title set, a present index number (2 bytes: BCD) of the track, and a reserved area (2 bytes). The present time information of 16 bytes is composed of playback time (4 bytes: BCD) of the track, remaining playback time (4 bytes: BCD) of the track, absolute time (4 bytes: BCD) of the title , and remaining absolute time (4 bytes: BCD) of the title.

[0056]

The title set search information of 8 bytes is composed of a first sector number (4 bytes) of the title set, and a last sector number (4 bytes) of the title set. The title search information of 8 bytes is composed of a first sector number (4 bytes) of the title, and a last sector number (4 bytes) of the title. The track search information of 404 bytes is composed of track and sector numbers (4 bytes × 99) of the title, a first track number (4 bytes) of the title, and a last track number (4 bytes) of the title.

[0057]

The index search information of 408 bytes is composed of index and sector numbers (4 bytes × 100) of the track, a first index number (4 bytes) of the track, and a last index number (4 bytes) of the track. The highlight search information of 80 bytes is composed of an in-sector number (4 bytes × 10) of the track, and an out-sector number (4 bytes × 10) of the track.

[0058]

According to such a format, an A-CONT pack for managing an audio signal of following A packs as TOC information of a CD is placed at a head of a plurality of A packs. Thus, the audio data is not integral with the video data, and the recording capacity can be great. In addition, audio time can be managed by the A-CONT pack. Furthermore, simple character information such as a tune name related to the audio data can be extracted by the A-CONT pack.

[0059]

The TOC information of a title, a start address, a playing time, and

others is located in the A-CONT pack. Even in audio playback, it is possible that information according to operation by a user is taken out of the A-CONT pack, and playback is started. The TOC information is placed in the audio manager information (AMGI) and the audio title set information (ATSI), and thereby the necessary TOC information is stored in a memory within a player apparatus so that information according to operation by the user can be immediately read out from the memory and playback can be started. Since it is unnecessary to memorize information of a great capacity such as program chain information (PGCI) in a DVD-video, the disc can be efficiently managed.

[0060]

Furthermore:

1. In the case where video (V) data is absent from the contents;

(1) search and random access with respect to three layers being a title, a tune, and an index are made possible;

(2) random access, time search, and head finding in GOF (audio frame) unit are made possible; and

(3) time of a title, a tune, and an index can be managed in real time.

[0061]

2. In the case where video (V) data is present in the contents;

with respect to audio data, in addition to the above-mentioned (1) ~ (3);

(4) present time and remaining time in a title and a tune can be indicated and managed in real time.

[0062]

With respect to video data;

(1) search and random access with respect to three layers being a title,

a PTT, and a cell are made possible;

(2) random access, time search, and head finding in video frame unit are made possible;

(3) time of a title, a PTT, and a cell can be managed in real time; and

(4) present time and remaining time in a PTT or a title can be indicated and managed in video frame unit time.

[0063]

The ACBU of Fig. 12 contains an A-CONT pack and a CONT pack not shown. As shown in Fig. 18, it may be designed so that it will not contain any V pack and CONT pack. In this case, although a video signal is not recorded, there is a feature that the recording capacity for an audio signal is increased. Thus, it is possible to reduce the disc size. In addition, a playback function can be simplified. Therefore, it is possible to provide a thing suited for a portable playback apparatus.

[0064]

Fig. 19 shows recording times (TIME) which occur in the case where an analog audio signal is sampled at various sampling frequencies, and is quantized with various quantization bit numbers, and it is recorded on a DVD-audio disc with only 2 channels, 2 channel + multiple channels (6 ch, 8 ch), or multiple channels (6 ch, 8 ch). In the case where a sound recording person side chooses the quantization bit number and the sampling frequency fs of each channel and implements the recording of sound in this way, recording for several tens of minutes to 300 minutes or longer can be done on one disc.

[0065]

Fig. 20 shows the recording times (TIME) which occur in the

case where 2 ch + 6 ch are present, and the 6 channels are front 3 channels, rear 2 channels, and LFE 1 channel, and in the case where only 6 channels are present, and the 6 channels are front 3 channels, rear 2 channels, and LFE 1 channel. Even in the case where the sampling frequency fs and the quantization bit number are selected for each of the channels and the sampling frequencies fs of the respective channels are made in common, about 1 hour can be recorded on one disc provided that the bands of the rear 2 channels and the LFE 1 channel or only the band of the LFE 1 channel is narrowed to implement compression and the recording is done. In the case where it is recorded while being compressed, a player side implements expansion and interpolation on the basis of thinned data of rear 2 ch + LFE 1 ch shown in Fig. 11 or only LFE 1 ch and then D/A conversion can be carried out at an original sampling frequency fs.

[0066]

In the case where stream signals of multiple channels and stereophonic 2 channels are recorded on a disc, a disc D may be divided into, for example, a multiple channel area 1 and a stereophonic 2 channel area in an inner side and an outer side as shown in Fig. 21 and the recording may be done. In this case, limitations of various types can be reduced even when the sampling frequencies and the quantization bit numbers of the multiple channels and the stereophonic 2 channels are different.

[0067]

In the above explanation, the above-mentioned digital audio signals of the multiple channels are of linear PCM. The audio encoding

mode may be Dolby AC-3, MPEG-1, or MPEG-2. In these cases, the sampling frequency and the quantization bit number are set to the standard values for channels other than front channels, and the sampling frequency fs and the quantization/DRC information in the ATSM-AST-ATR (Fig. 9) are adopted for the front channels. Thus, different sampling frequencies and different quantization bit numbers can be selected. Thereby, it is possible to provide a digital disc which can be accepted by users in a great width.

[0068]

As shown in Fig. 15, the ACD area in the ACD packet may be designed to have data of the character "1" of the first language and the character "2" of the second language. Alternatively, it may be designed as follows. As shown in Fig. 22, data related to the character "2" is omitted. It is composed of a general information area of 48 bytes, an area of 294 bytes which relates to the character "1" of one language and which is for indicating "audio navigation" such as a tune name as shown in Fig. 16, and an audio playback control information area of 294 bytes. Similarly, the area of the character "1" is composed of a name space area of 93 bytes, two free space areas each having 93 bytes, and a data pointer area of 15 bytes.

[0069]

The contents of the audio playback control information area are arbitrary, and it is composed of, for example, audio playback control information areas (250 bytes) for 10 types each of 25 bytes, and a reserved area of 44 bytes. Graphic equalizer information of 20 bytes, level balance information of 3 bytes, and reverberation adding

information of 2 bytes are placed in the audio playback control information area for one type. This information is selected by a user, and the tone quality of an audio signal is controlled. The audio playback control information is data recommended by a professional mixer such that in the case where the user plays back a tune placed in A packs, the tone quality during the playback will be optimized depending on the type (classic, jazz, rock, and BGM) of the tune, and depending on the environments, the record conditions, and the playing conditions of the tune even in the same type. In the case where the channel number of the audio signal is 6, a mixing coefficient for mixing down the channel number to 2 and implementing stereophonic playback is placed in the reserved area.

[0070]

Next, a second embodiment will be explained. Fig. 23 shows the format of the second embodiment of a DVD audio disc related to this invention. This format does not contain any VTS such as shown in Fig. 25 to Fig. 27, and is composed of only ATS. The ATS is composed of an audio manager (AMG) shown in Fig. 1(b), audio manager menu (AMGM) of video and audio, and ATS<1> and ATS<2> managed by AMGI in the AMG. The ATS<1> and the ATS<2> do not contain any A-CONT packs as shown in Fig. 24, and are composed of A packs and still picture packs. Many still picture packs are not arranged with respect to A packs, and they are arranged such that there is about one pack per track.

[0071]

For reference, Fig. 25 shows the format of a DVD-Van (video +

audio navigation) disc. In summary, this format is composed of a video title set (VTS) as DVD video data, and an ANV title set (ANV-TS) as audio navi (navigation) data. In more detail, the VTS is the same in structure as a DVD video disc shown in Fig. 1(a) and Fig. 26 mentioned later. On the other hand, the ANV-TS is composed of an audio manager (AMg) shown in Fig. 1(b), and ATS<1> and ATS<2> managed by AMGI in the AMG and making pairs with VTS<1> and VTS<2> in a VTS side respectively.

As shown in Fig. 26 and Fig. 1(a), the format of a DVD video disc does not contain ATS and ANV-TS, and is composed of only VTS.

[0072]

Fig. 27 shows the format of a DVD-Avd (audio + AV data). In summary, this format is composed of a video title set (VTS) as DVD-video data, and an audio title set (ATS) as DVD-audio data. In more detail, the VTS is composed of a video manager (VMG) shown in Fig. 1(a), a video manager menu (VMGM) of video and audio, and VTS<1> managed by VMGI in the VMG.

[0073]

On the other hand, the ATS is composed of an audio manager (AMG) shown in Fig. 1(b), an audio manager menu (AMGM) of video and audio, ATS<1> managed by AMGI in the AMG and making a pair with audio data in the VTS<1> in the VTS side, and ATS<2> managed by the AMGI in the AMG. As shown in Fig. 24, the ATS<2> does not contain any A-CONT pack, and is composed of A packs and still picture packs.

[0074]

Fig. 28 shows audio only title audio object attribute (AOTT-AOB-

ATR) recorded on a disc as attribute data denoting the contents of audio data in the disc of the second embodiment. The attribute data has 8 bytes (64 bits b63 ~ b0), and is composed, from the MSB side, of:
an audio encoding mode of 3 bits (b63 ~ b61);
a down mix (D-M) mode of 1 bit (b60);
a multiple channel type of 4 bits (b59 ~ b56);
a quantization bit number Q1 for a channel group 1 which is of 4 bits (b55 ~ b52);
a quantization bit number Q2 for a channel group 2 which is of 4 bits (b51 ~ b48);
a sampling frequency fs1 for the channel group 1 which is of 4 bits (b47 ~ b44);
a sampling frequency fs2 for the channel group 2 which is of 4 bits (b43 ~ b40);
a reserved area of 3 bits (b39 ~ b37);
channel assignment of 5 bits (b36 ~ b32); and
a reserved area of remaining 32 bits (b31 ~ b0).
The remaining 32 bits (b31 ~ b0) are used for attribute data of the respective channels.

[0075]

The above-mentioned data will be explained in more detail below.

(1) Audio encoding mode (b63 ~ b61):
0000b: a linear PCM mode;
0001b: reserved for compression audio (Dolby digital);
0010b: reserved for compression audio (MPEG2 without extension);
0011b: reserved for compression audio (MPEG2 with extension);

0100b: reserved for compression audio (DTS);

0101b: reserved for compression audio (SDDS); and

others: reserved for other encoding modes.

(2) Down mix mode (b60):

0b: down mix stereophonic output allowance;

1b: down mix stereophonic output inhibition.

(3) Multiple channel type (b59 ~ b56):

000b: type 1

others: reserved.

[0076]

(4) Quantization bit number Q1 (b55 ~ b52) for the channel group 1:

0000b: 16 bits;

0001b: 20 bits;

0010b: 24 bits;

others: reserved.

(5) Quantization bit number Q2 (b51 ~ b48) for the channel group 2:

"0000b" when the quantization bit number Q1 for the channel group 1 is "0000b";

"0000b" or "0001b" when the quantization bit number Q1 for the channel group 1 is "0001b"; and

"0000b", "0001b", or "0010b" when the quantization bit number Q1 for the channel group 1 is "0010b";

where:

0000b: 16 bits;

0001b: 20 bits;

0010b: 24 bits;

others: reserved.

[0077]

(6) Sampling frequency fs1 (b47 ~ b44) for the channel group 1:

0000b: 48 kHz;

0001b: 96 kHz;

0010b: 192 kHz;

1000b: 44.1 kHz;

1001b: 88.2 kHz;

1010b: 176.4 kHz;

others: reserved.

[0078]

(7) Sampling frequency fs2 (b43 ~ b40) for the channel group 2:

"0000b" when the sampling frequency fs1 for the channel group 1 is "0000b";

"0000b" or "0001b" when the sampling frequency fs1 for the channel group 1 is "0001b";

"0000b", "0001b", or "0010b" when the sampling frequency fs1 for the channel group 1 is "0010b";

"1000b" when the sampling frequency fs1 for the channel group 1 is "1000b";

"1000b" or "1001b" when the sampling frequency fs1 for the channel group 1 is "1001b"; and

"1000b", "1001b", or "1010b" when the sampling frequency fs1 for the channel group 1 is "1010b".

[0079]

(8) Channel assignment:

Fig. 29 shows 21 combinations of channel assignment information (pattern) of the groups "1" and "2" from 1 channel (monaural) to 6 channels. The characters shown in the drawing will be explained below.

C (mono): monaural;

L, R: 2 channel stereophony;

Lf: left front of multiple channels;

Rf: right front of multiple channels;

C: center of multiple channels;

LFE: Low Frequency Effect (low frequency effect) of multiple channels;

S: surround of multiple channels;

Ls: left surround of multiple channels;

Rs: right surround of multiple channels;

none: corresponding to nothing.

[0080]

The disc of the second embodiment uses the linear PCM mode. An A pack of the linear PCM has 2048 bytes or less, and the contents thereof are formed by a pack header of 14 bytes and an A packet shown in Fig. 30. The A packet is composed of a packet header of 17, 9, or 14 bytes, a private header shown in detail in Fig. 31, and audio data (linear PCM) having 1 to 2013 bytes.

[0081]

As shown in Fig. 31, the private header is composed of:

sub stream ID of 8 bits;

a reserved area of 4 bits;

an ISRC number of 4 bits;

ISRC data of 8 bits;

a private header length of 8 bits;

a first access unit pointer of 16 bits;

audio data information (ADI) of 6 bytes; and

stuffing bytes of 0 ~ 7 bytes.

[0082]

The ADI is composed of:

an audio emphasis flag of 1 bit;

a reserved area of 1 + 2 bits;

a down mix code of 4 bits;

a quantization word length "1" for the group "1" which is of 4 bits;

a quantization word length "2" for the group "2" which is of 4 bits;

an audio sampling frequency fs1 for the group "1" which is of 4 bits;

an audio sampling frequency fs2 for the group "2" which is of 4 bits;

a reserved area of 4 bits;

a multiple channel type of 4 bits;

a reserved area of 3 bits;

channel assignment information (see Fig. 29) of 5 bits; and

dynamic range control information of 8 bits.

[0083]

Fig. 32 is a block diagram showing an embodiment of an encoding apparatus for an audio signal which relates to this invention. Fig. 33 is a block diagram which shows, in detail, a signal processing circuit in Fig. 32. In Fig. 32, an analog audio signal A is sampled by an A/D converter 31 at a sufficiently high sampling frequency (a sampling period Δt), for example, 192 kHz, and is converted into a PCM signal which has a high

resolution and which has, for example, 24 bits, and is converted into the following data sequence corresponding to a curved line α of a high resolution:

xb1, x1, xa1, x2, xb2, x3, xa2,

•••, xbi, x2i-1, xai, x2i, •••

This data sequence (xbi, x2i-1, xai, x2i) is encoded by a signal processing circuit 32 shown in detail in Fig. 33 and a memory 33, and is then applied to a DVD formatting portion 34.

[0084]

With reference to Fig. 33, the structure of the signal processing circuit 32 will be explained in detail. Firstly, in the case where compression is not implemented as in the second embodiment, the PCM data converted by the A/D converter 31 is applied to an allocation circuit 40 as it is, and is assigned to audio data (linear PCM) shown in Fig. 30, and is then formatted into an A pack shown in Fig. 30 by the DVD formatting portion 34.

[0085]

On the other hand, in the case where compression is executed, a low pass filter (LPF) 36 which passes a band of 1/2, for example, an FIR filter, derives, from the data sequence (xbi, x2i-1, xai, x2i) corresponding to the curved line α of the high resolution, the following band-limited data sequence which corresponds to a curved line β of a low resolution:

xc1, *, *, *, xc2, *, *, *, xc3, *, *, *, ···, xci,

*, *, *, ···

The data "*" are removed from this data sequence by a thinning circuit

37, and thereby the following data sequence is generated.

xc1, xc2, xc3, ···, xci, ···

Here, the data sequence xci is a data sequence which results from band-limiting the digital data A/D-converted by the A/D converter 31 and reducing the sampling frequency to 1/4.

[0086]

The data xi are removed from the data sequence (xbi, x2i-1, xai, x2i) by a thinning circuit 38, and thereby the following data sequence is generated.

xb1, xa1, xb2, xa2, ···, xbi, xai, ···

[0087]

On the basis of these data sequences xci, xbi, and xai, an adder 39 which operates as a difference calculator calculates the following differences.

xbi – xci = Δ1i

xai – xci = Δ2i

Here, the difference data Δ1i and Δ2i are of 24 bits or less, and the bit number may be fixed or variable. The allocation circuit 40 packs (1 packet = 2034 bytes) the data sequence xci and the difference data Δ1i and Δ2i into user data (see Fig. 13), and outputs the user data to the DVD formatting portion 34.

[0088]

A video signal V is converted by an A/D converter 31V into a digital signal. Then, the digital video signal is encoded by a V encoder 32V into an MPEG format, and is subsequently packed into user data shown in Fig. 13, being applied to the DVD formatting portion 34. The

DVD formatting portion 34 implements packing into a format as previously mentioned. The data which is formatted by the DVD formatting portion 34 is modulated by a modulation circuit 35 according to a modulation system corresponding to the disc, and the disc is made on the basis of the modulation data.

[0089]

Fig. 34 shows an apparatus for playing back the disc of the first embodiment shown in Fig. 1(b). On the DVD audio disc 1, the data having the above-mentioned structure is recorded in a form of pits while being subjected to EFM modulation. When tune selection, playback, fast forward, or stop operation is done via an operation portion 18 or a remote control device 19, a control portion (CPU) 23 controls a drive device 2 and a reproducing device 17 in accordance with the operation. During the playback, pit data recorded on the DVD audio disc 1 is read out by the drive device 2 before being subjected to EFM demodulation.

[0090]

In the reproducing device 17, this signal is sent to a CONT pack detection portion 3 and an A-CONT pack detection portion 9. The CONT pack detection portion 3 detects a CONT pack in the reproduced data, and sets a control parameter in a parameter portion 8 and sequentially writes V packs controlled by the CONT pack into a V pack buffer 4. User data (a video signal and sub picture information) in the V packs written in the V pack buffer 4 are taken out in the pack order on the basis of SCR (see Fig. 13) in the V packs, and in the order of output time on the basis of PTS (Presentation Time Stamp) in the CONT pack,

and are then outputted as an analog video signal via an image converting portion 6, a D/A converting portion 7, and video output terminals 15 and 15'.

[0091]

The A-CONT pack detection portion 9 detects an A-CONT pack in the reproduced data, and sets a control parameter in a parameter portion 14 and sequentially writes A packs controlled by the A-CONT pack into an A pack buffer 10. User data (an audio signal) in the A packs written in the A pack buffer 10 are taken out in the pack order on the basis of SCR by a buffer taking out portion 11 and in the order of output time on the basis of present time (see Fig. 17) of the audio search data ASD in the A-CONT pack, and are then outputted as an analog audio signal via a PCM converting portion 12, a D/A converting portion 13, and an audio output terminal 16. Display data (the audio character display data ACD shown in Fig. 15 and Fig. 16) in the A-CONT pack is sent to a display signal generating portion, and a display signal is generated.

[0092]

Fig. 35 is a block diagram functionally showing the structure shown in Fig. 34. A reproducing means 2 corresponds to the drive device 2 shown in Fig. 34. A reproduced signal process separation means A (9, 10, 11, 14) corresponds to the A-CONT pack detection portion 9, the A-pack buffer 10, the buffer taking out portion 11, and the parameter portion 14. An audio signal output means (12, 13) corresponds to the PCM converting portion 12 and the D/A converting portion 13. A character information output means 20 corresponds to

the above-mentioned display signal generating portion. A display signal from the character information output means 20 is outputted via a display signal output terminal 22, or is outputted to an internal character display portion 21. A reproduced signal process separation means V (3, 4, 5, 8) corresponds to the CONT pack detection portion 3, the V pack buffer 4, the buffer taking out portion 5, and the parameter portion 8. A video signal output means and a sub picture information output means (6, 7) correspond to the image converting portion 6 and the D/A converting portion 7. A control means 23 corresponds to the control portion 23.

[0093]

In Fig. 35, when a command signal for playing back a desired tune is sent to the control means 23 from the operation portion 18 or the remote control device 19, it sends an address control information signal depending on the playback command to the reproducing means 2. Thereby, the desired tune is played back from the DVD audio disc 1. The reproduced signal process separation means A separates reproduced data, and sends A-CONT information to the control means 23 and sends an audio signal to the audio signal output means (12, 13) and sends character information to the character information output means 20. The reproduced signal process separation means V separates reproduced data, and sends CONT information to the control means 23 and sends a video signal and sub picture information to the video signal means and the sub picture information output means (6, 7) respectively. Here, audio search data (ASD) such as shown in Fig. 17 may be recorded on a TOC information area of the disc so that a head of

a tune can be found.

[0094]

Fig. 36 and Fig. 37 show an apparatus for playing back a disc of the second embodiment (the format shown in Fig. 24). Similarly, when tune selection, playback, fast forward, or stop operation is done via an operation portion 18 or a remote control device 19, a control portion 23 controls a drive device 2 and a reproducing device 17 in accordance with the operation. During the playback, pit data recorded on the DVD audio disc 1 is read out by the drive device 2 before being subjected to EFM demodulation.

[0095]

In the reproducing device 17, this signal is sent to a V pack detection portion 3 and an A and D pack detection portion 9. In the case where V packs are recorded on the disc 1, the V pack detection portion 3 detects V packs in the reproduced data, and sets a control parameter in a parameter portion 8 and sequentially writes the V packs in a V pack buffer 4. User data (a video signal and sub picture information) in the V packs written in the V pack buffer 4 are taken out by a buffer taking out portion 5 in the pack order on the basis of SCR (see Fig. 13) in the V packs, and in the order of output time on the basis of PTS (Presentation Time Stamp) in the CONT pack, and are then outputted as an analog video signal via an image converting portion 6, a D/A converting portion 7, and video output terminals 15 and 15'.

[0096]

The A and D pack detection portion 9 detects A packs and D packs in the reproduced data, and sets a control parameter in a

parameter portion 14 and sequentially writes A packs and D packs into an A and D pack buffer 10. User data (an audio signal) in the A packs written in the A and D pack buffer 10 are taken out by a buffer taking out portion 11 in the pack order and in the order of output time, and are then outputted as an analog audio signal via a PCM converting portion 12, a D/A converting portion 13, and an audio output terminal 16. Display data in the D packs is sent to a display signal generating portion 20, and a display signal is generated. The display signal is outputted via a display signal output terminal 22, or is outputted to an internal character display portion 21.

[0097]

[Advantage of the Invention]

As explained above, in this invention, the sound recording person side can arbitrarily choose the sampling frequency and the quantization bit number for the digital audio signal of each channel of multiple channels. The digital audio signal of each channel, its quantization bit number, and its sampling frequency are recorded on the digital disc. The DVD audio player side can implement D/A conversion of the digital audio signal of each channel on the basis of the quantization bit number and the sampling frequency. The sound recording person side can implement the recording of sound for an approximately constant recording time such that the recording time and the tone quality will be different. Even when the recording time and the tone quality of the recorded audio signal are different, playback can be done by a player of one kind.

[BRIEF EXPLANATION OF THE DRAWINGS]

[Fig. 1]

It is an explanation view showing one embodiment of the format of a DVD-video and the format of a DVD-audio related to this invention.

[Fig. 2]

It is an explanation view which shows, in detail, the format of an audio manager (AMG) in Fig. 1.

[Fig. 3]

It is an explanation view which shows, in detail, the format of an audio title set (ATS) in Fig. 1.

[Fig. 4]

It is an explanation view which shows, in detail, the format of an audio manager information (AMGI) in Fig. 2.

[Fig. 5]

It is an explanation view which shows, in detail, the format of an audio title set attribute table (ATS-ATRT) in Fig. 4.

[Fig. 6]

It is an explanation view which shows, in detail, the format of audio title set attribute data (ATS-ATR) in Fig. 5.

[Fig. 7]

It is an explanation view which shows, in detail, the format of audio title set information (ATSI) in Fig. 3.

[Fig. 8]

It is an explanation view which shows, in detail, the format of an audio title set information management table (ATSI-MAT) in Fig. 7.

[Fig. 9]

It is an explanation view which shows, in detail, audio title set

menu audio stream attribute data (ATSM-AST-ATR) in Fig. 8.

[Fig. 10]

It is an explanation view which shows, in detail, the format of an audio title set audio stream attribute table (ATS-AST-ATRT) in Fig. 8.

[Fig. 11]

It is an explanation view which shows, in detail, attribute data (ATS-AST-ATR) of each audio stream in Fig. 10.

[Fig. 12]

It is an explanation view which shows an audio contents block unit (ACBU) in Fig. 1.

[Fig. 13]

It is an explanation view which shows, in detail, the format of a video pack and an audio pack in Fig. 12.

[Fig. 14]

It is an explanation view which shows, in detail, the format of an audio control (A-CONT) pack in Fig. 12.

[Fig. 15]

It is an explanation view which shows, in detail, the format of an audio character display (ACD) area in Fig. 12.

[Fig. 16]

It is an explanation view which shows an example displayed by name space information in Fig. 15.

[Fig. 17]

It is an explanation view which shows, in detail, the format of an audio search data (ASD) area in Fig. 14.

[Fig. 18]

It is an explanation view showing a modified example of an audio contents block unit in Fig. 1.

[Fig. 19]

It is an explanation view showing the relation among the channel, the quantization bit number, the sampling frequency, and the recording time.

[Fig. 20]

It is an explanation view showing an example of sound recording in which the channel, the quantization bit number, and the sampling frequency are different.

[Fig. 21]

It is an explanation view showing another example of an audio area of multiple channels and stereophonic 2 channels.

[Fig. 22]

It is an explanation view showing another example of the format of the audio character display (ACD) area in Fig. 15.

[Fig. 23]

It is an explanation view showing the basic format of a DVD-audio disc in a second embodiment.

[Fig. 24]

It is an explanation view showing the audio data structure of the DVD-audio disc in Fig. 23.

[Fig. 25]

It is an explanation view showing the basic format of a DVD-Van disc.

[Fig. 26]

It is an explanation view showing the basic format of a DVD video disc.

[Fig. 27]

It is an explanation view showing the basic format of a DVD-Avd disc.

[Fig. 28]

It is an explanation view showing AOTT-AOB-ATR in the DVD-audio disc in the second embodiment.

[Fig. 29]

It is an explanation view showing, in detail, channel assignment information in Fig. 28.

[Fig. 30]

It is an explanation view showing the format of a linear PCM audio (A) pack of the DVD audio disc in the second embodiment.

[Fig. 31]

It is an explanation view showing, in detail, a private header in Fig. 30.

[Fig. 32]

It is a block diagram showing an embodiment of an encoding apparatus for an audio signal which relates to this invention.

[Fig. 33]

It is a block diagram showing, in detail, a signal processing circuit in Fig. 32.

[Fig. 34]

It is a block diagram showing a playback apparatus for a DVD-audio disc related to this invention.

[Fig. 35]

It is a block diagram functionally showing a playback apparatus in Fig. 34.

[Fig. 36]

It is a block diagram showing a playback apparatus for a DVD-audio disc in the second embodiment.

[Fig. 37]

It is a block diagram functionally showing a playback apparatus in Fig. 36.

[Explanation of Characters]

1 multiple channel area

2 stereophonic 2 channel area

A audio pack (audio area)

A-CONT audio control pack

ACB audio contents block

ACBS audio contents block set

ACBU audio contents block unit

AMG audio manager

ATS audio title set

ATS-AST-ATRT audio title set audio stream attribute table (quantization control information area)

ATS-ATRT audio title set attribute table (quantization control information area)

ATSI audio title set information

CONT control pack

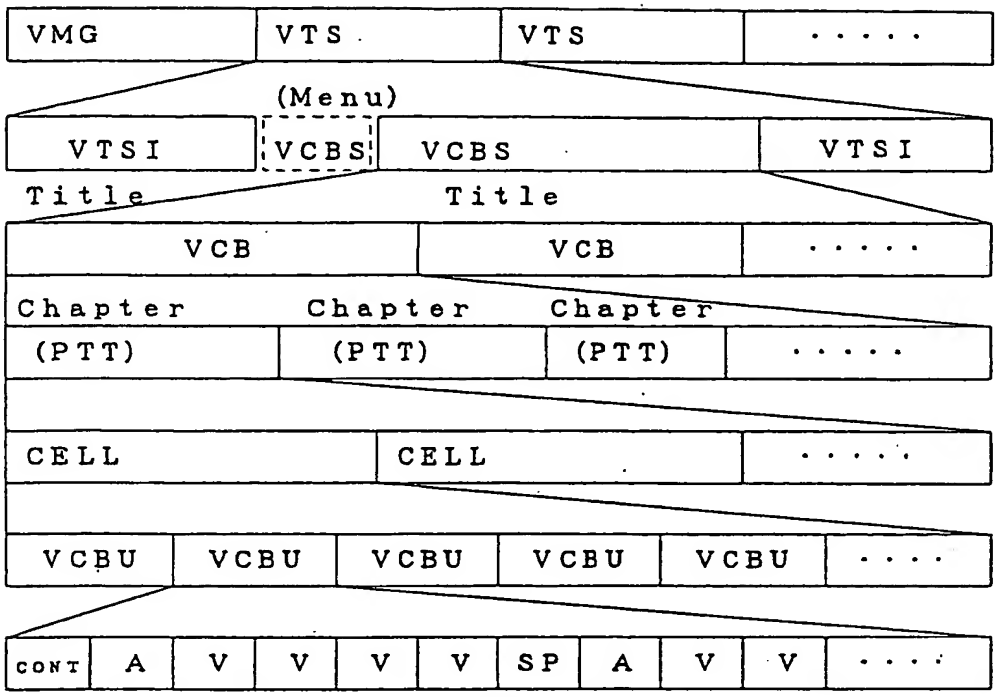
D disc

10-18013

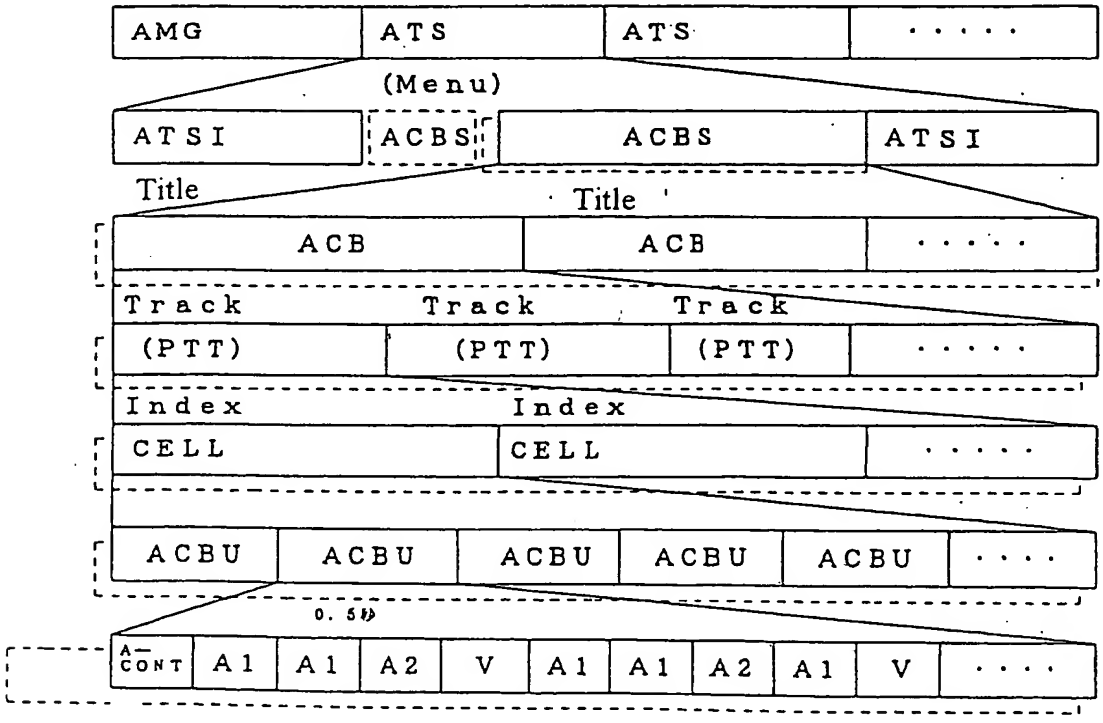
V video pack

【図1】FIG. 1

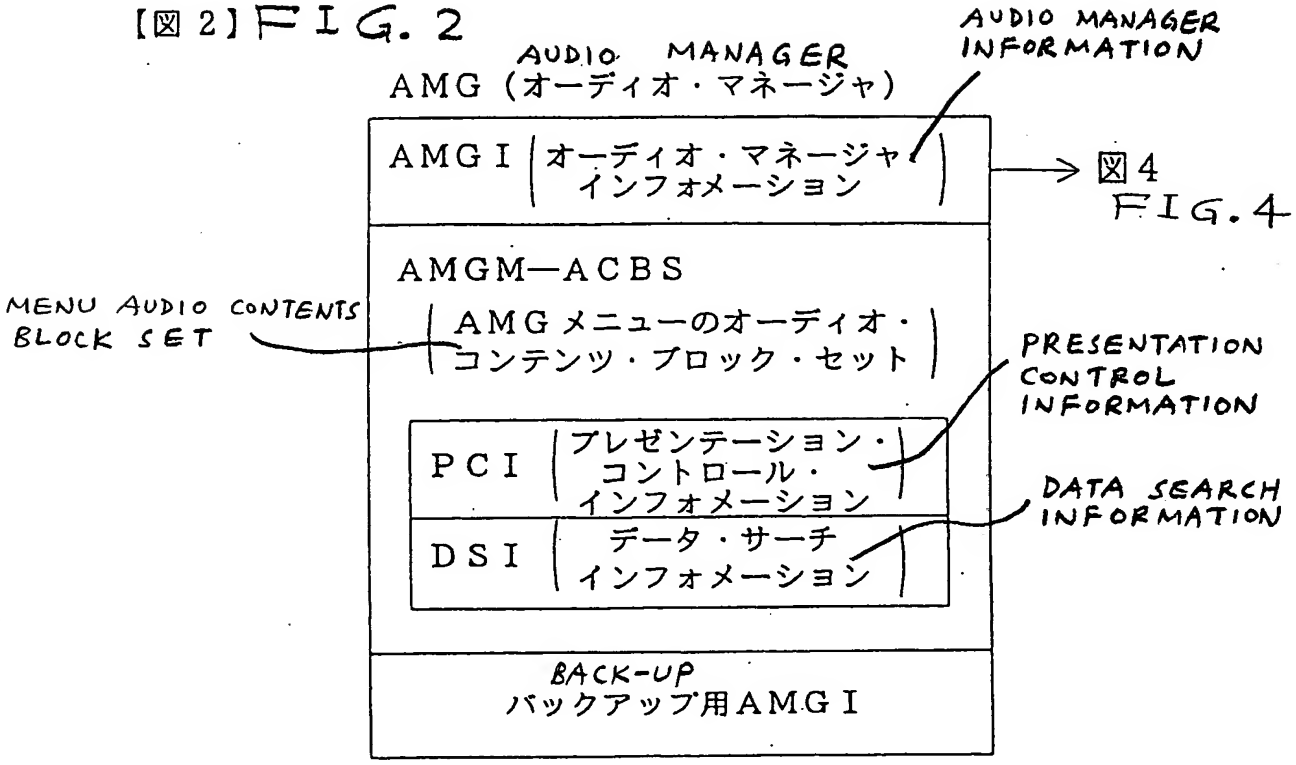
(a) DVD－ビデオ VIDEO



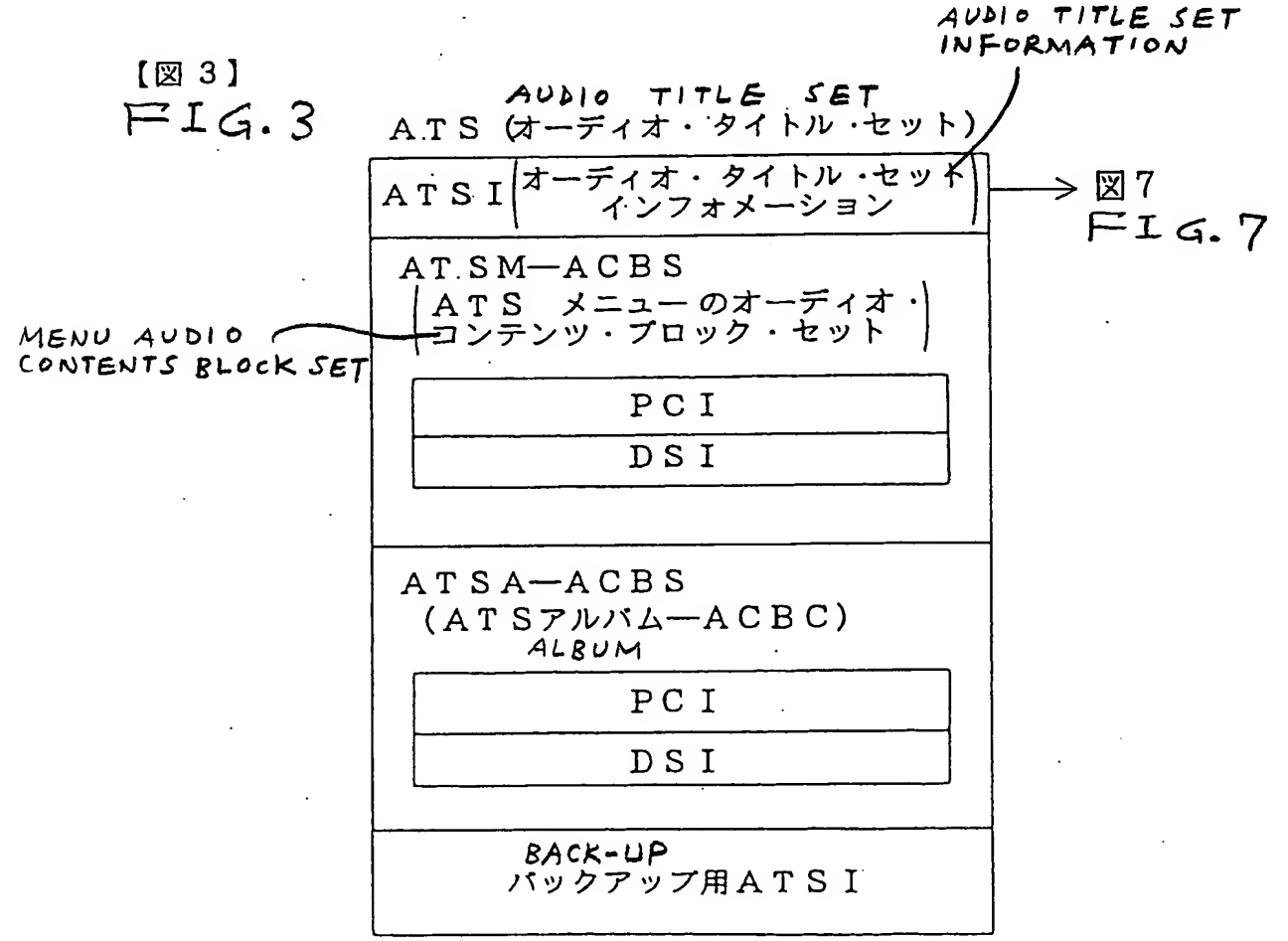
(b) DVD－オーディオ AUDIO



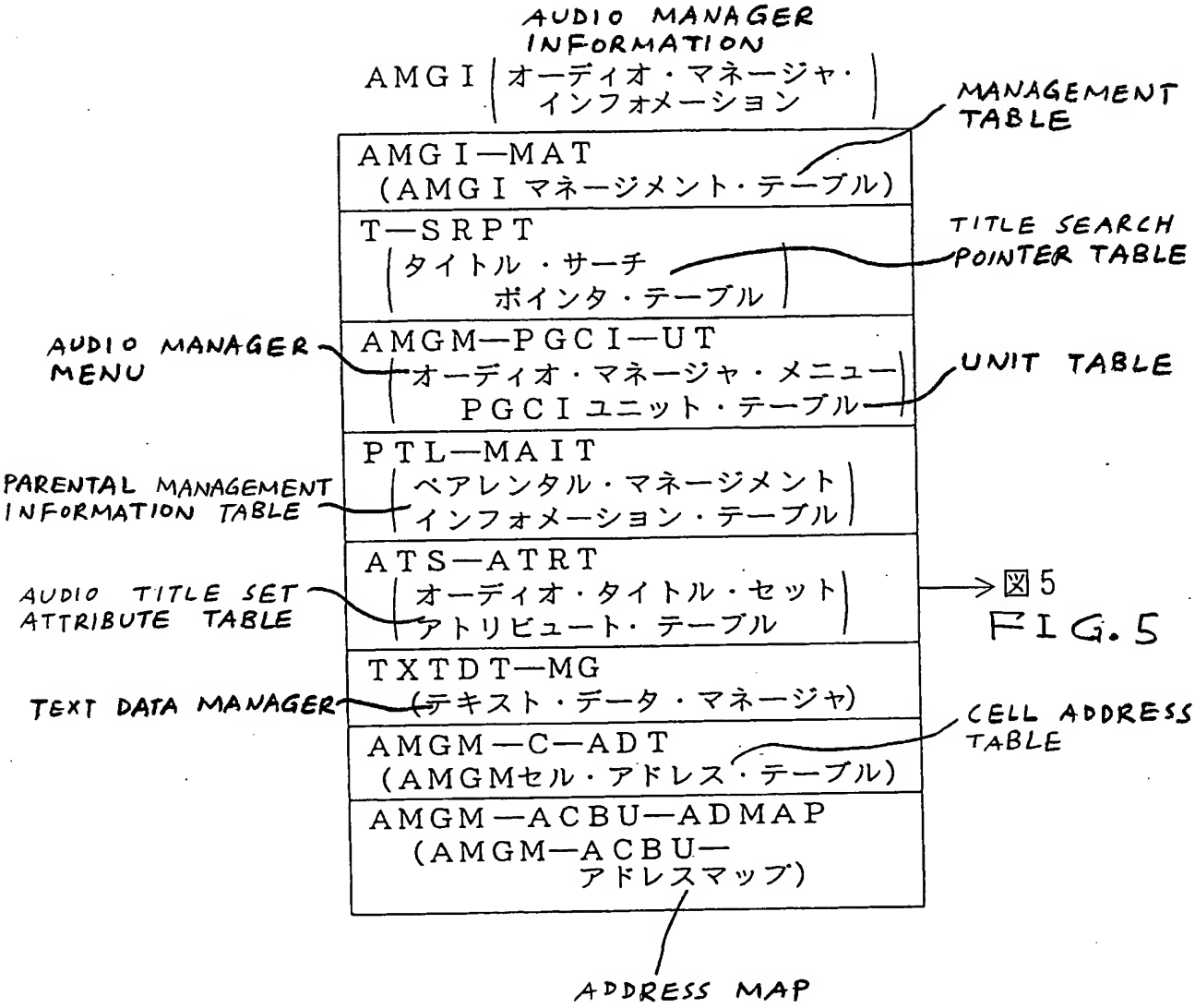
【図2】FIG. 2



【図3】FIG. 3

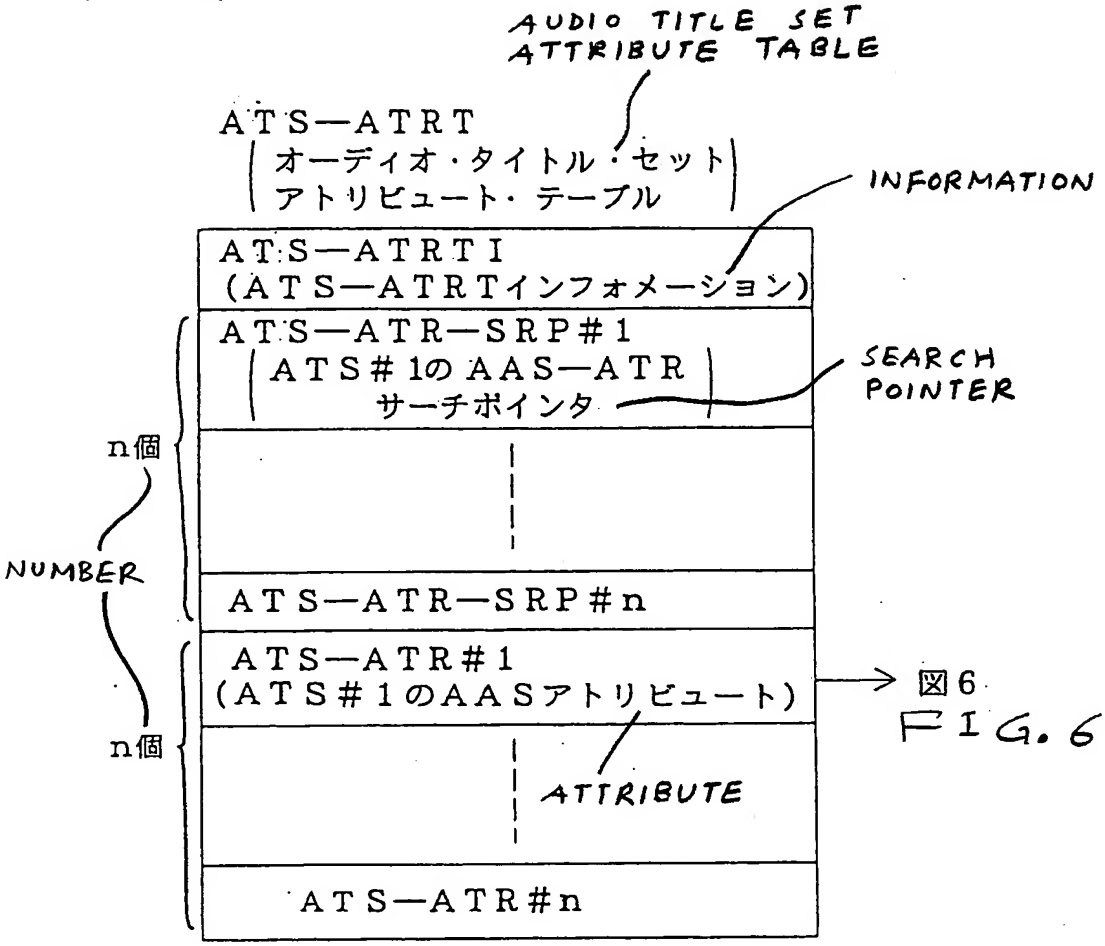


【図4】
FIG. 4



→図5
FIG. 5

【図５】ＦＩＧ．５


AUDIO TITLE SET ATTRIBUTE TABLE
ＡＴＳ—ＡＴＲＴ
オーディオ・タイトル・セット
アトリビュート・テーブル
INFORMATION
ＡＴＳ—ＡＴＲＴＩ
（ＡＴＳ—ＡＴＲＴインフォメーション）
ＡＴＳ—ＡＴＲ—ＳＲＰ＃１
ＡＴＳ＃１のＡＡＳ—ＡＴＲ
サーチポインタ
SEARCH POINTER
n個
NUMBER
ＡＴＳ—ＡＴＲ—ＳＲＰ＃ｎ
ＡＴＳ—ＡＴＲ＃１
（ＡＴＳ＃１のＡＡＳアトリビュート）
図６
ＦＩＧ．６
n個
ATTRIBUTE
ＡＴＳ—ＡＴＲ＃ｎ

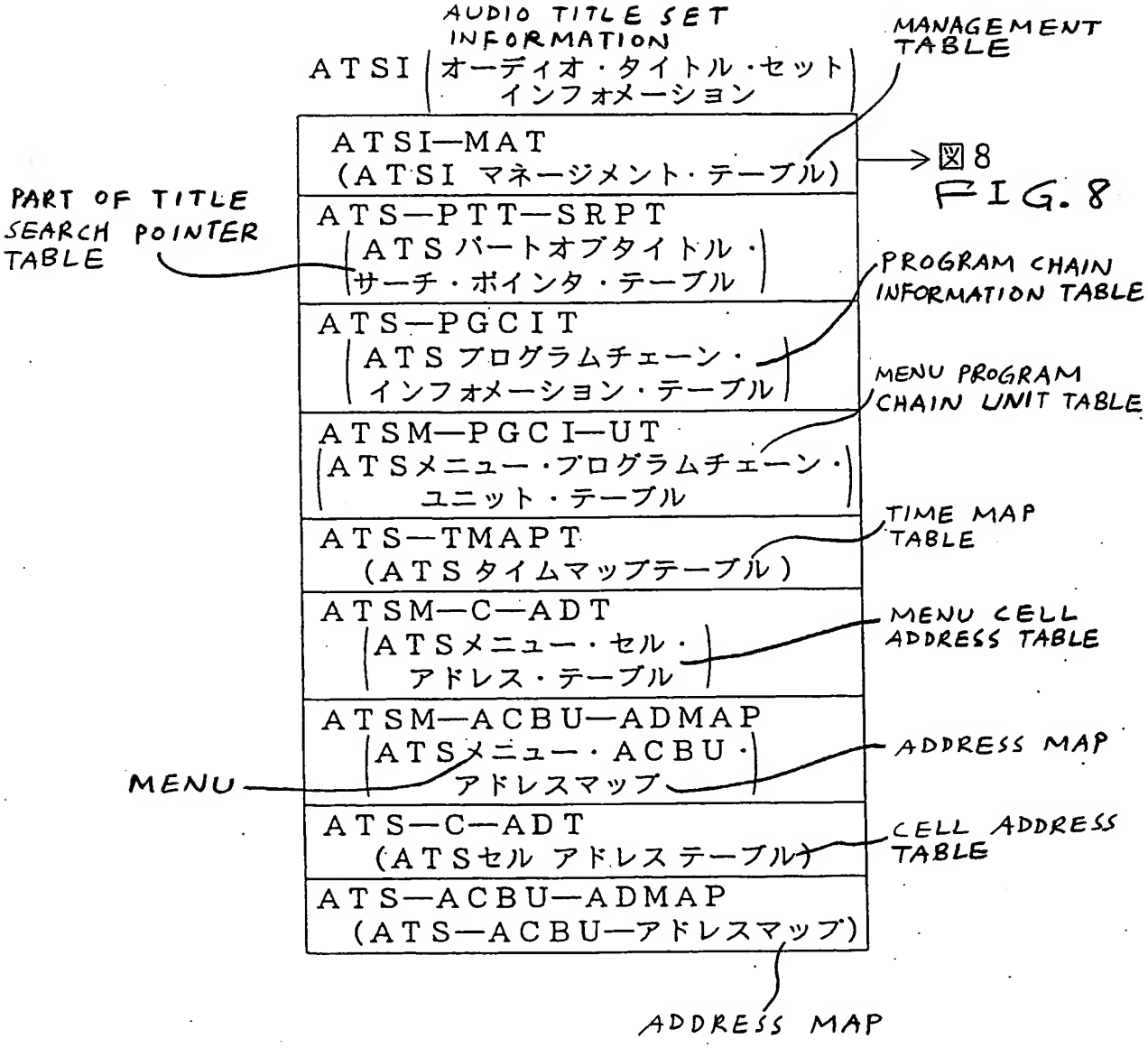
【図6】FIG.6

ATS—ATR (ATSアトリビュート) ATTRIBUTE

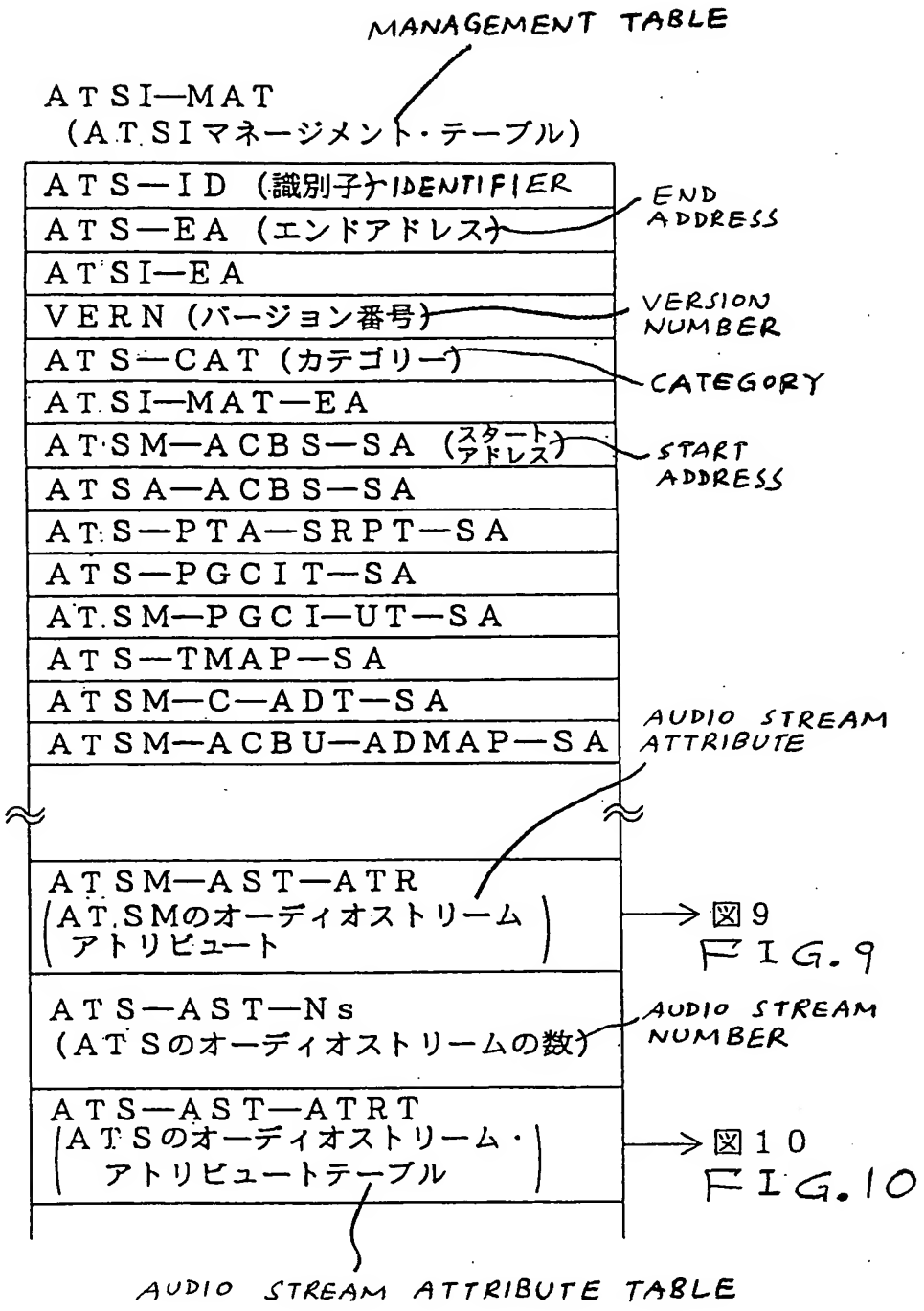
ATS—ATR—EA (エンドアドレス) END ADDRESS	4バイト
ATS—CAT (カテゴリー) CATEGORY	4バイト
ATS—ATRI (ATS—ATRインフォメーション) INFORMATION	768バイト

BYTES

【図7】FIG. 7


AUDIO TITLE SET INFORMATION
ATSI
オーディオ・タイトル・セット インフォメーション
MANAGEMENT TABLE
ATSI—MAT
(ATSI マネージメント・テーブル)
→図8 FIG. 8
PART OF TITLE SEARCH POINTER TABLE
ATS—PTT—SRPT
ATSパートオブタイトル・サーチ・ポインタ・テーブル
PROGRAM CHAIN INFORMATION TABLE
ATS—PGCIT
ATSプログラムチェーン・インフォメーション・テーブル
MENU PROGRAM CHAIN UNIT TABLE
ATSM—PGCI—UT
ATSメニュー・プログラムチェーン・ユニット・テーブル
TIME MAP TABLE
ATS—TMAPT
(ATSタイムマップテーブル)
MENU CELL ADDRESS TABLE
ATSM—C—ADT
ATSメニュー・セル・アドレス・テーブル
ADDRESS MAP
ATSM—ACBU—ADMAP
ATSメニュー・ACBU・アドレスマップ
MENU
CELL ADDRESS TABLE
ATS—C—ADT
(ATSセル アドレス テーブル)
ATS—ACBU—ADMAP
(ATS—ACBU—アドレスマップ)
ADDRESS MAP

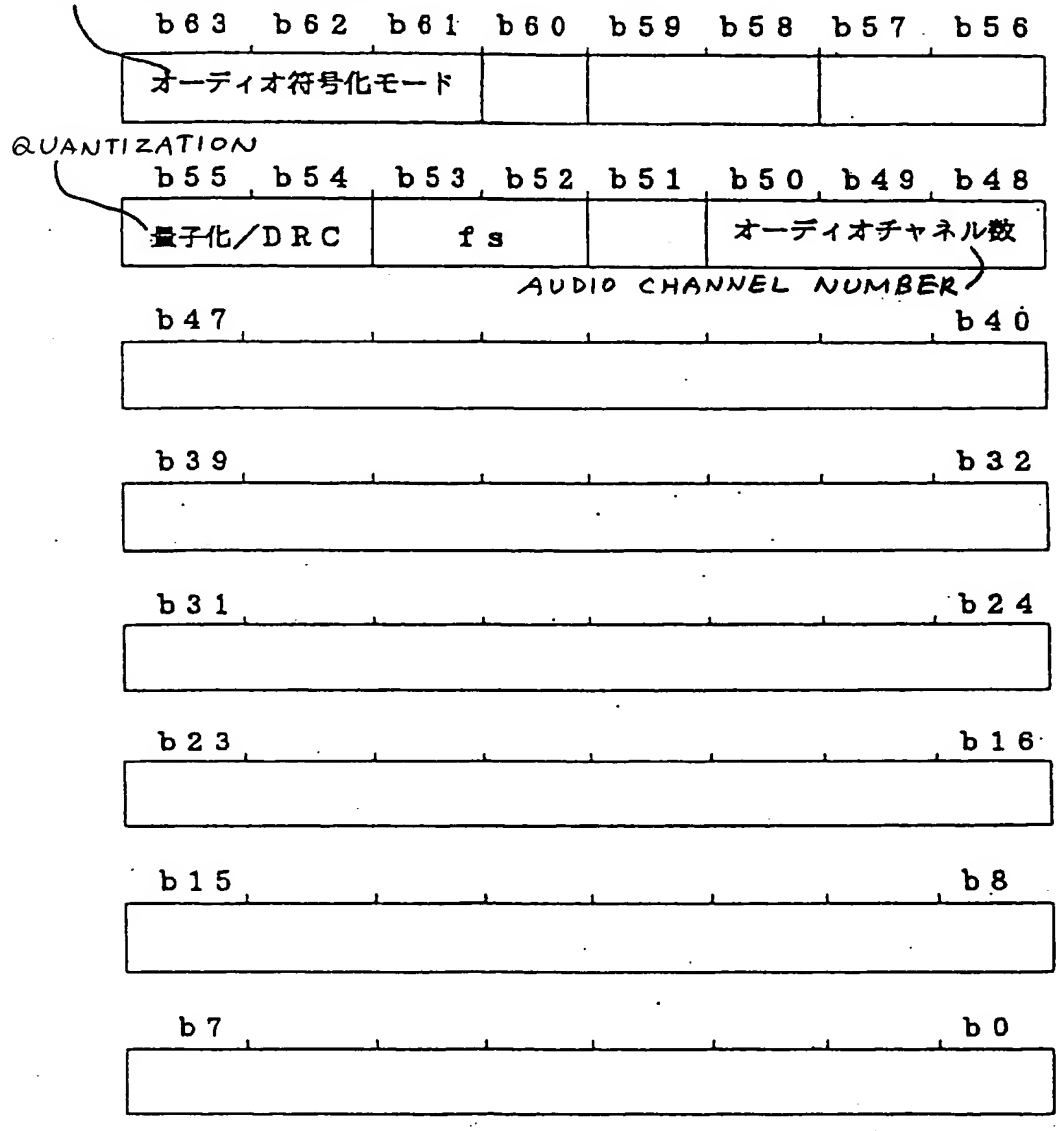
【図８】ＦＩＧ．８


MANAGEMENT TABLE
ＡＴＳＩ—ＭＡＴ
（ＡＴＳＩマネージメント・テーブル）
ＡＴＳ—ＩＤ（識別子）
IDENTIFIER
ＡＴＳ—ＥＡ（エンドアドレス）
END ADDRESS
ＡＴＳＩ—ＥＡ
ＶＥＲＮ（バージョン番号）
VERSION NUMBER
ＡＴＳ—ＣＡＴ（カテゴリー）
CATEGORY
ＡＴＳＩ—ＭＡＴ—ＥＡ
ＡＴＳＭ—ＡＣＢＳ—ＳＡ（スタートアドレス）
START ADDRESS
ＡＴＳＡ—ＡＣＢＳ—ＳＡ
ＡＴＳ—ＰＴＡ—ＳＲＰＴ—ＳＡ
ＡＴＳ—ＰＧＣＩＴ—ＳＡ
ＡＴＳＭ—ＰＧＣＩ—ＵＴ—ＳＡ
ＡＴＳ—ＴＭＡＰ—ＳＡ
ＡＴＳＭ—Ｃ—ＡＤＴ—ＳＡ
ＡＴＳＭ—ＡＣＢＵ—ＡＤＭＡＰ—ＳＡ
AUDIO STREAM ATTRIBUTE
ＡＴＳＭ—ＡＳＴ—ＡＴＲ
（ＡＴＳＭのオーディオストリームアトリビュート）
→図９
ＦＩＧ．９
ＡＴＳ—ＡＳＴ—Ｎｓ
（ＡＴＳのオーディオストリームの数）
AUDIO STREAM NUMBER
ＡＴＳ—ＡＳＴ—ＡＴＲＴ
（ＡＴＳのオーディオストリーム・アトリビュートテーブル）
→図１０
ＦＩＧ．１０
AUDIO STREAM ATTRIBUTE TABLE

【図9】
FIG. 9

AUDIO TITLE SET MENU
AUDIO STREAM ATTRIBUTE DATA
(オーディオタイトルセット / メニュー・オーディオストリーム / アトリビュートデータ)

ATSM—AST—ATR



【図10】FIG. 10

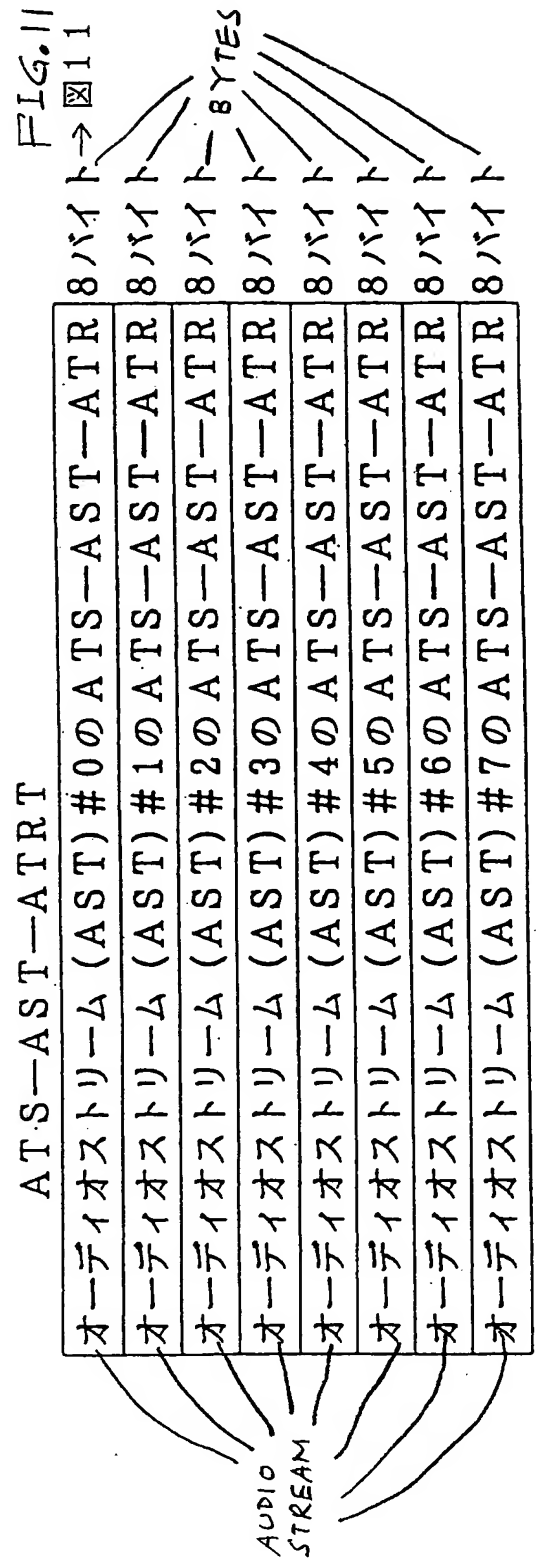
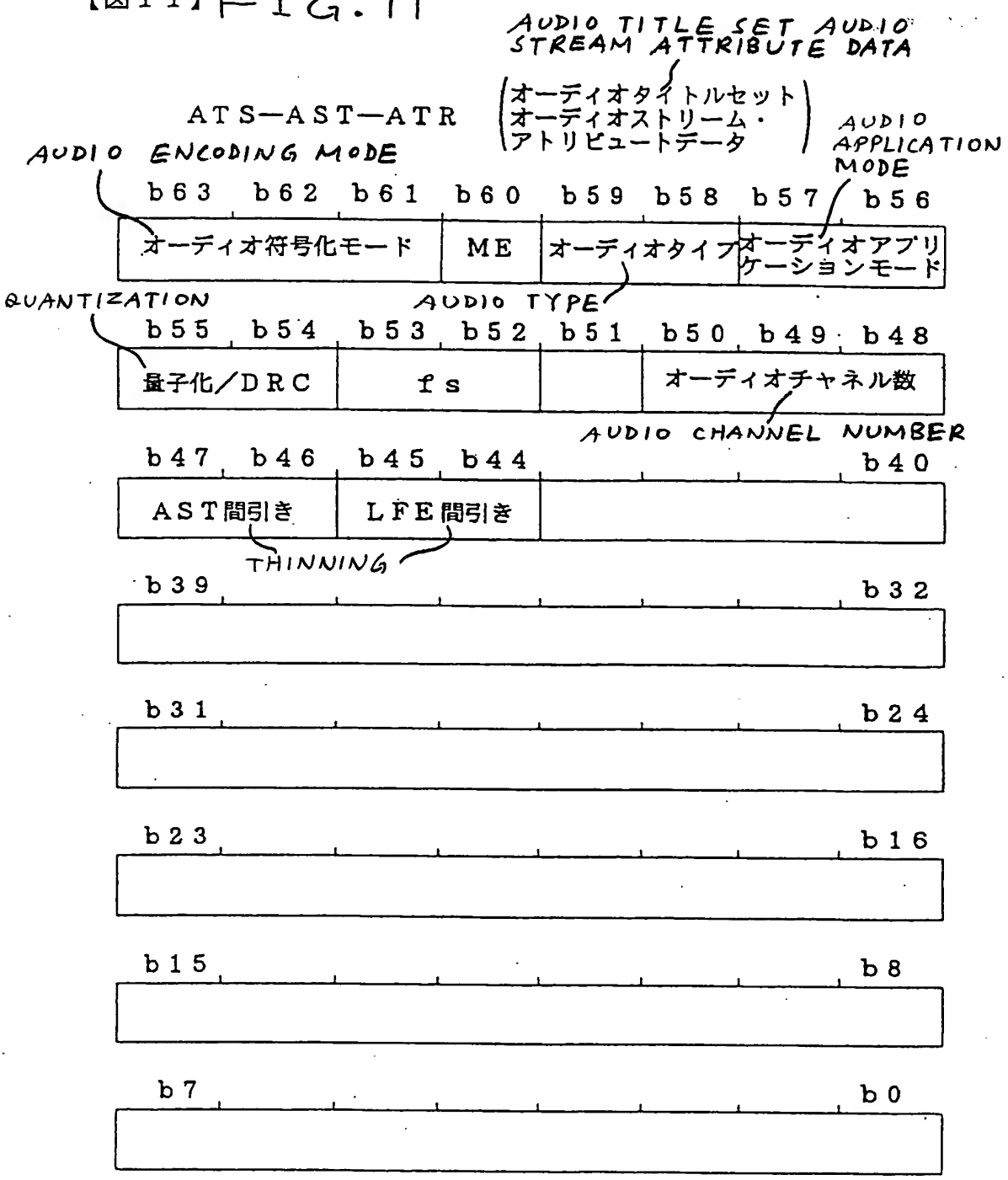
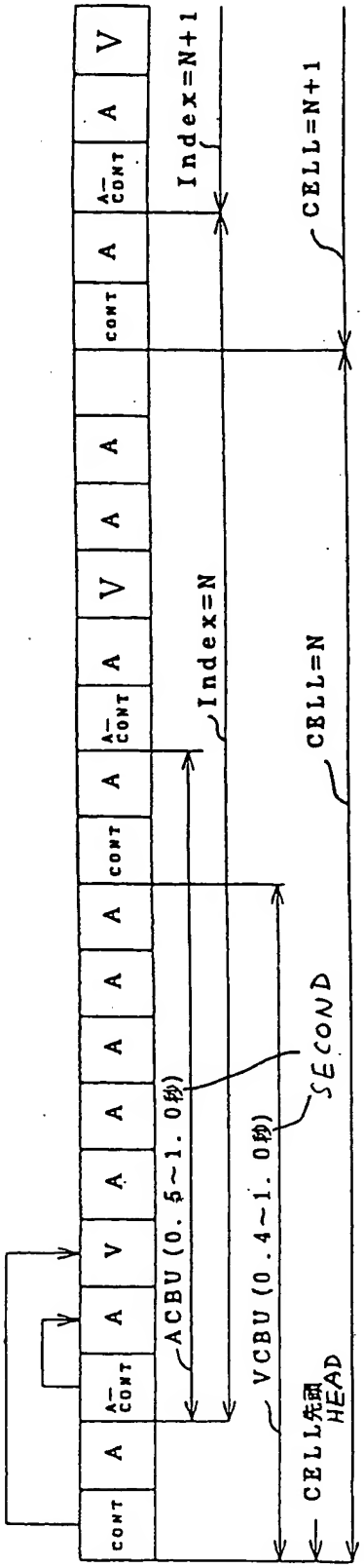


FIG. 11
→図11
8バイト
8 BYTES
ATS—AST—ATRT
オーディオストリーム (AST) #0のATS—AST—ATR
オーディオストリーム (AST) #1のATS—AST—ATR
オーディオストリーム (AST) #2のATS—AST—ATR
オーディオストリーム (AST) #3のATS—AST—ATR
オーディオストリーム (AST) #4のATS—AST—ATR
オーディオストリーム (AST) #5のATS—AST—ATR
オーディオストリーム (AST) #6のATS—AST—ATR
オーディオストリーム (AST) #7のATS—AST—ATR
AUDIO STREAM

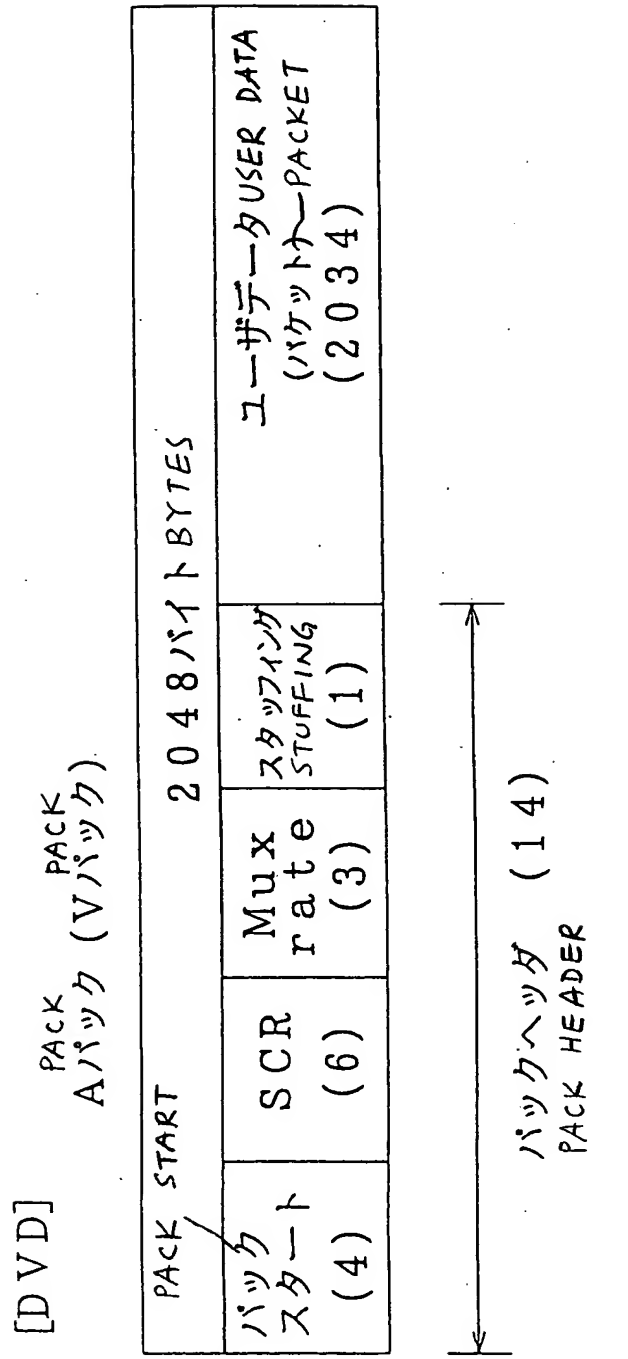
【図１１】FIG. 11


AUDIO TITLE SET AUDIO STREAM ATTRIBUTE DATA
オーディオタイトルセット
オーディオストリーム・
アトリビュートデータ
ATS—AST—ATR
AUDIO ENCODING MODE
AUDIO APPLICATION MODE
b63 b62 b61 b60 b59 b58 b57 b56
オーディオ符号化モード
ME
オーディオタイプ
オーディオアプリケーションモード
QUANTIZATION
AUDIO TYPE
b55 b54 b53 b52 b51 b50 b49 b48
量子化／DRC
fs
オーディオチャネル数
AUDIO CHANNEL NUMBER
b47 b46 b45 b44 b40
AST間引き
LFE間引き
THINNING
b39 b32
b31 b24
b23 b16
b15 b8
b7 b0

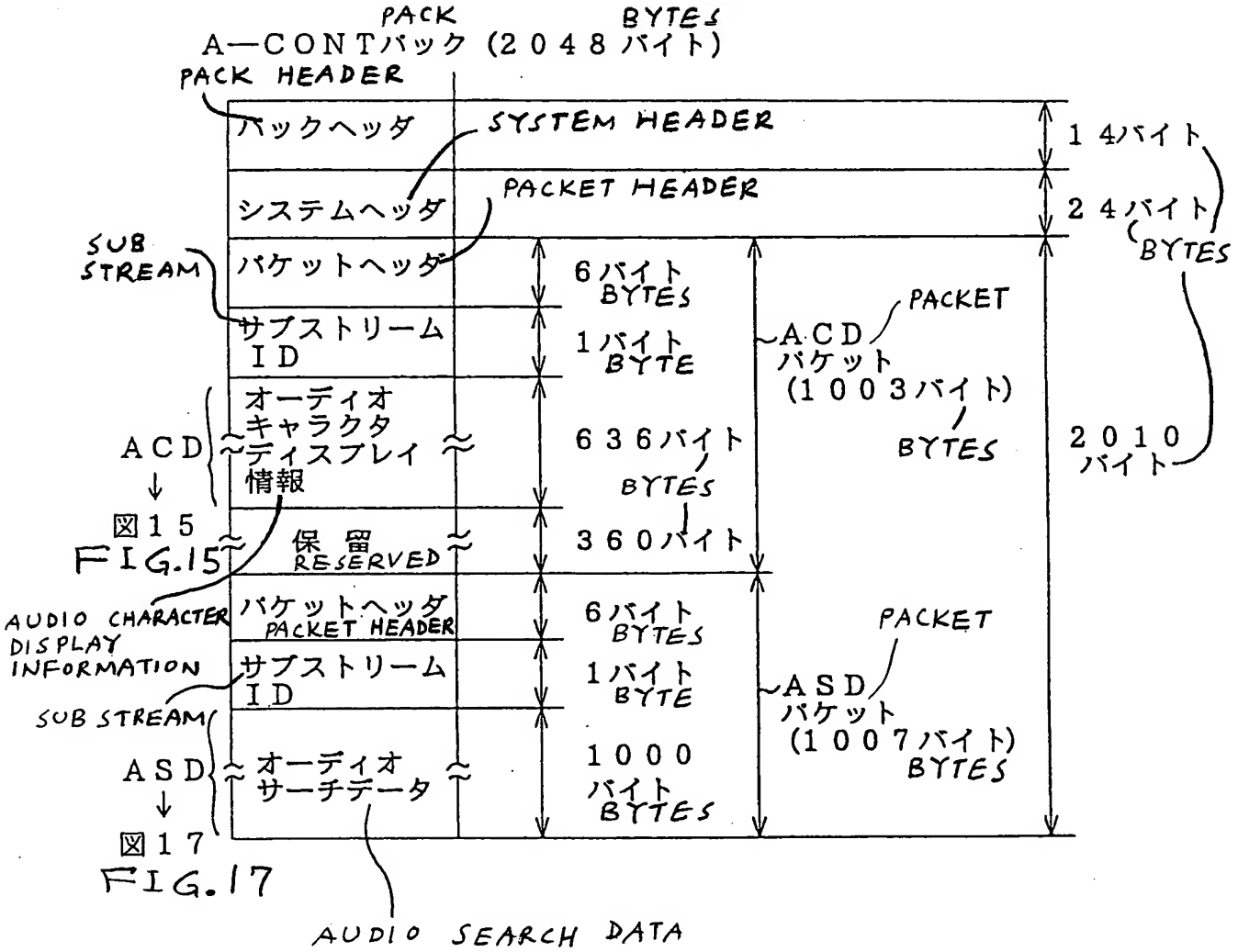
【図12】FIG. 12


CONT
A
A-CONT
A
V
ACBU (0.5~1.0秒)
VCBU (0.4~1.0秒)
SECOND
CELL先頭
HEAD
Index=N
Index=N+1
CELL=N
CELL=N+1

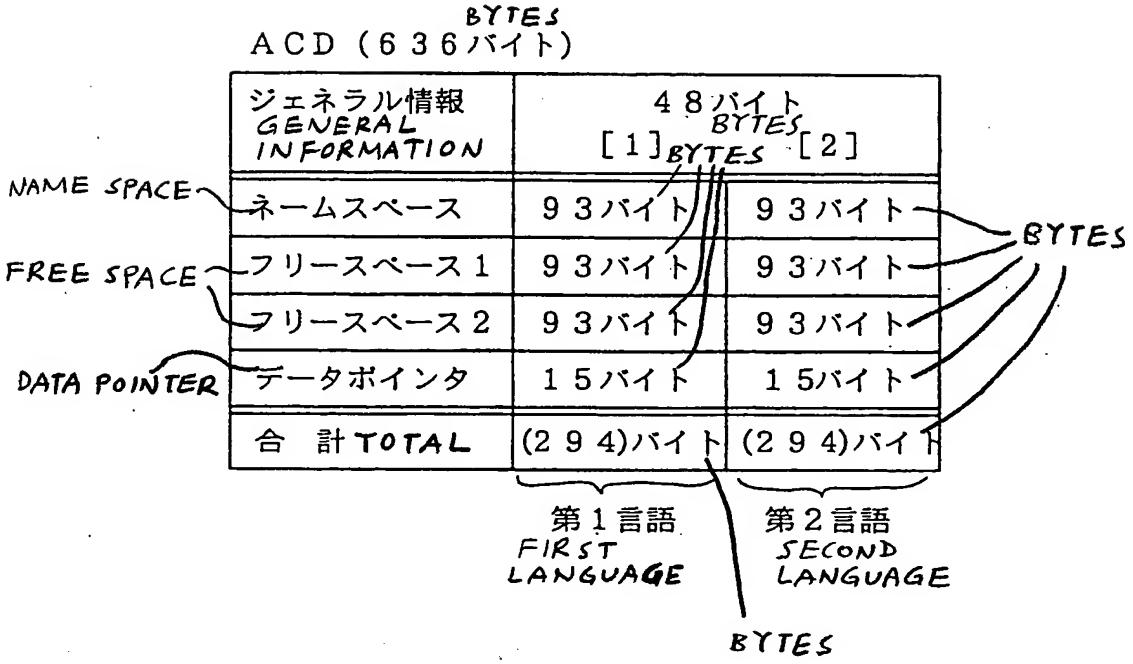
【図１３】FIG. 13


[DVD]
PACK
Aパック（Vパック）
PACK START
2048バイトBYTES
パック スタート (4)
SCR (6)
Mux rate (3)
スタッフィング STUFFING (1)
ユーザデータ USER DATA (パケット PACKET (2034)
パックヘッダ (14)
PACK HEADER

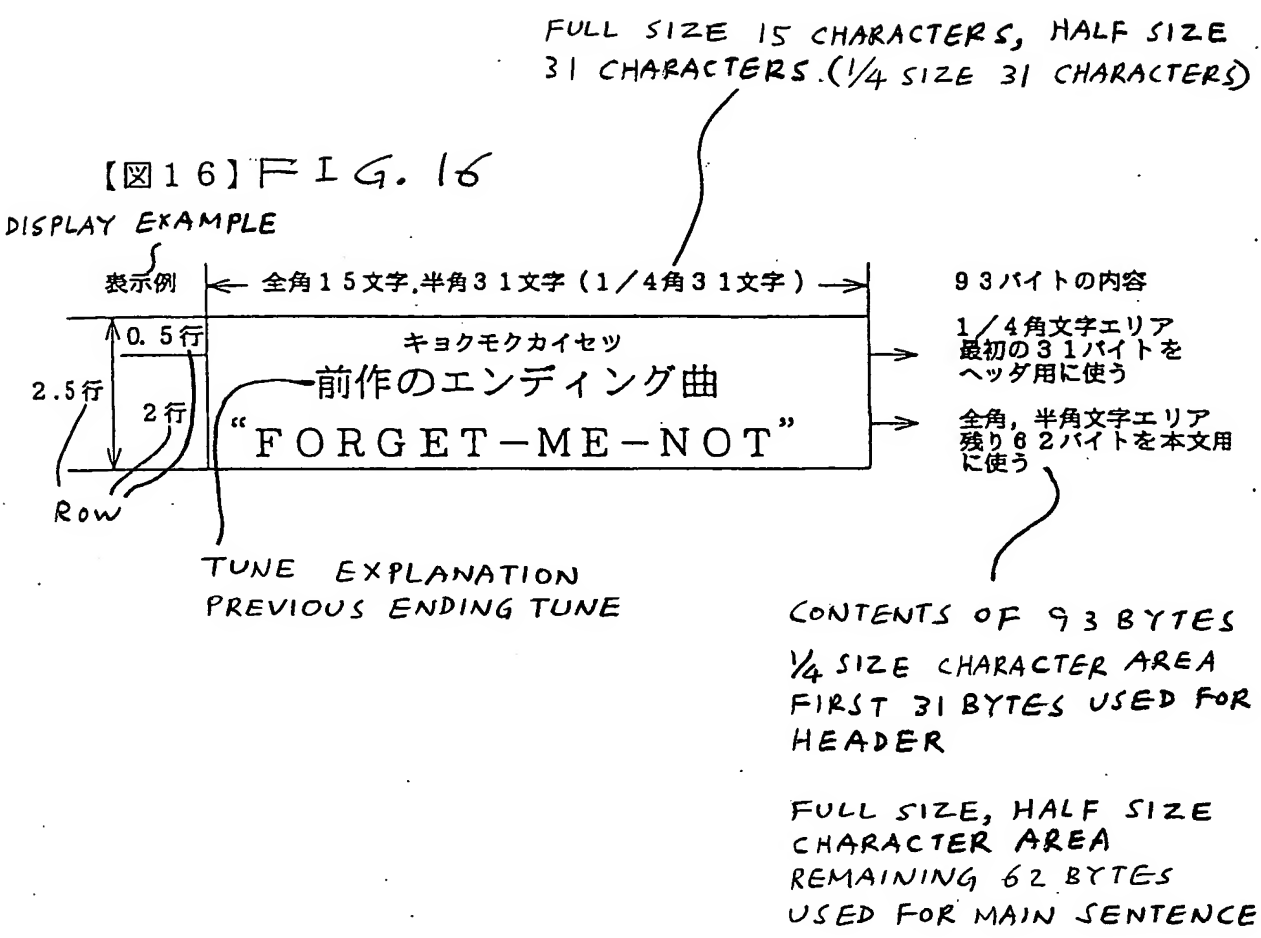
【図１４】ＦＩＧ．１４


PACK
BYTES
A—CONTパック（２０４８バイト）
PACK HEADER
パックヘッダ
SYSTEM HEADER
１４バイト
システムヘッダ
PACKET HEADER
２４バイト
BYTES
SUB STREAM
パケットヘッダ
６バイト BYTES
PACKET
ACD パケット（１００３バイト）
BYTES
サブストリーム ＩＤ
１バイト BYTE
オーディオ キャラクタ ディスプレイ 情報
ＡＣＤ
↓
図１５
FIG.15
６３６バイト BYTES
２０１０バイト
保留 RESERVED
３６０バイト
AUDIO CHARACTER DISPLAY INFORMATION
パケットヘッダ PACKET HEADER
６バイト BYTES
PACKET
ASD パケット（１００７バイト）
BYTES
サブストリーム ＩＤ
１バイト BYTE
SUB STREAM
ＡＳＤ
↓
図１７
FIG.17
オーディオ サーチデータ
１０００バイト BYTES
AUDIO SEARCH DATA

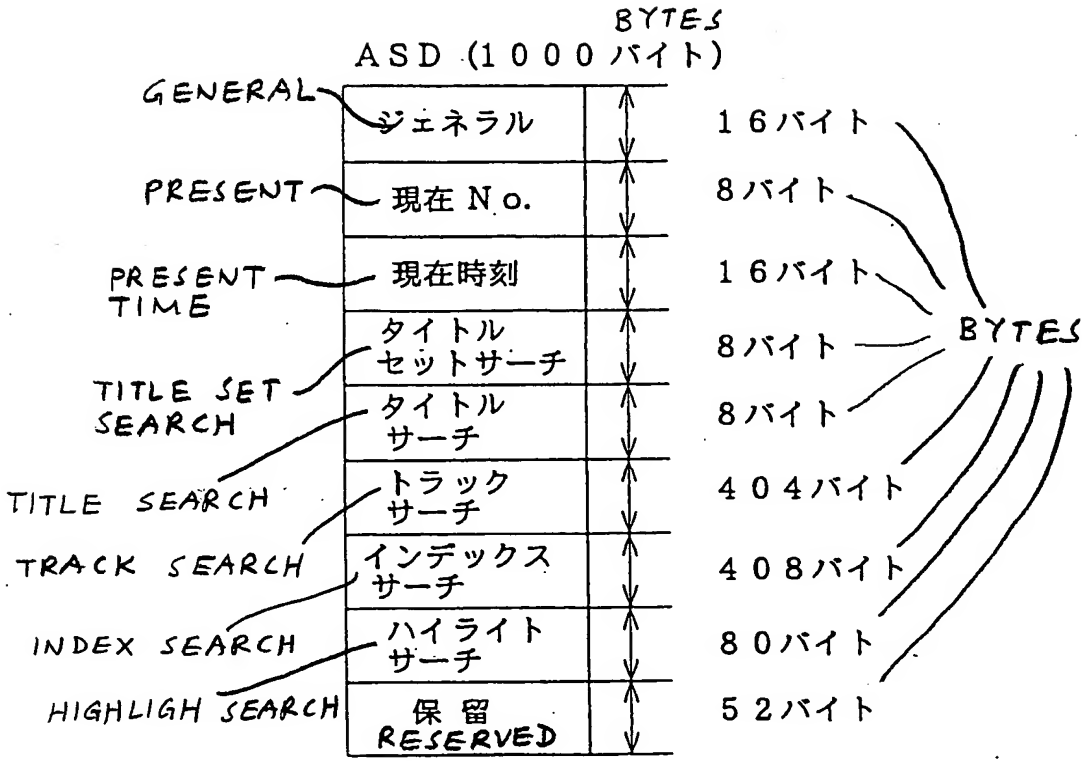
【図１５】FIG. 15


BYTES
ACD（６３６バイト）
ジェネラル情報 GENERAL INFORMATION
４８バイト
BYTES
[1] BYTES [2]
NAME SPACE
ネームスペース
９３バイト
９３バイト
BYTES
FREE SPACE
フリースペース１
９３バイト
９３バイト
フリースペース２
９３バイト
９３バイト
DATA POINTER
データポインタ
１５バイト
１５バイト
合　計 TOTAL
(２９４)バイト
(２９４)バイト
第１言語 FIRST LANGUAGE
第２言語 SECOND LANGUAGE
BYTES

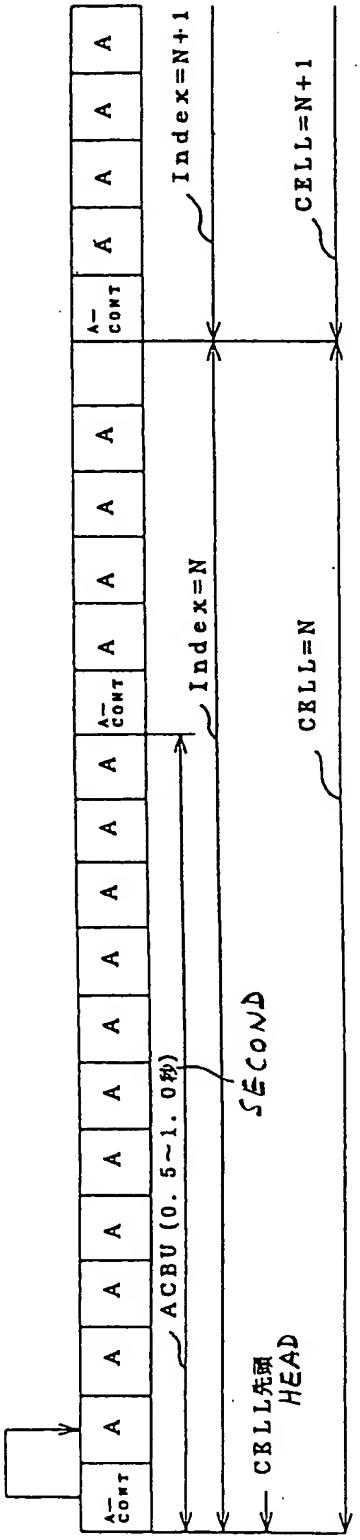
【図１６】FIG. 16


FULL SIZE 15 CHARACTERS, HALF SIZE 31 CHARACTERS (1/4 SIZE 31 CHARACTERS)
DISPLAY EXAMPLE
表示例
← 全角１５文字,半角３１文字（１／４角３１文字）→
９３バイトの内容
0.5行
2.5行
2行
キョクモクカイセツ
前作のエンディング曲
“FORGET－ME－NOT”
１／４角文字エリア
最初の３１バイトを
ヘッダ用に使う
全角，半角文字エリア
残り６２バイトを本文用
に使う
Row
TUNE EXPLANATION
PREVIOUS ENDING TUNE
CONTENTS OF 93 BYTES
1/4 SIZE CHARACTER AREA
FIRST 31 BYTES USED FOR
HEADER
FULL SIZE, HALF SIZE
CHARACTER AREA
REMAINING 62 BYTES
USED FOR MAIN SENTENCE

【図１７】FIG. 17


BYTES
ASD (１０００バイト)
GENERAL
ジェネラル
１６バイト
PRESENT
現在 No.
８バイト
PRESENT TIME
現在時刻
１６バイト
タイトル セットサーチ
８バイト
BYTES
TITLE SET SEARCH
タイトル サーチ
８バイト
TITLE SEARCH
トラック サーチ
４０４バイト
TRACK SEARCH
インデックス サーチ
４０８バイト
INDEX SEARCH
ハイライト サーチ
８０バイト
HIGHLIGH SEARCH
保留 RESERVED
５２バイト

【図18】FIG. 18


A-CONT
A
Index=N+1
CELL=N+1
Index=N
CELL=N
ACBU (0.5~1.0秒)
SECOND
CELL先頭
HEAD

10-18013

整理番号　409001397

【図19】 FIG. 19

	2CH(ステレオ) STEREOPHONIC	6CH	8CH	Mbps	TIME(a)	80以上 80 OR MORE
2ch	48khz/16bit(1.536Mbps) 48khz/20bit(1.920Mbps) 48khz/24bit(2.304Mbps)			1.536 1.920 2.304	387 310 258	* * *
	96khz/16bit(3.072Mbps) 96khz/20bit(3.804Mbps) 96khz/24bit(4.608Mbps)			3.072 3.804 4.608	194 156 129	* * *
	192khz/16bit(6.144Mbps) 192khz/20bit(7.680Mbps) 192khz/24bit(9.216Mbps)			6.144 7.680 9.216	97 78 65	*
2+6ch	48khz/16bit(1.536Mbps)	48khz/16bit(4.608Mbps) 48khz/20bit(5.760Mbps) 48khz/24bit(6.912Mbps)		6.144 7.296 8.448	97 82 70	* *
	48khz/20bit(1.920Mbps)	48khz/16bit(4.608Mbps) 48khz/20bit(5.760Mbps) 48khz/24bit(6.912Mbps)		6.528 7.680 8.832	91 78 67	*
	48khz/24bit(2.304Mbps)	48khz/16bit(4.608Mbps) 48khz/20bit(5.760Mbps) 48khz/24bit(6.912Mbps)		6.912 8.064 9.216	86 74 65	*
	96khz/16bit(3.072Mbps)	48khz/16bit(4.608Mbps) 48khz/20bit(5.760Mbps)		7.680 8.832	78 67	
	96khz/20bit(3.840Mbps)	48khz/16bit(4.608Mbps) 48khz/20bit(5.760Mbps)		8.448 9.600	71 62	
	96khz/24bit(4.608Mbps)	48khz/16bit(4.608Mbps)		9.216	65	
2+8ch	48khz/16bit(1.536Mbps)		48khz/16bit(6.144Mbps) 48khz/20bit(7.680Mbps)	7.680 9.216	78 65	
	48khz/20bit(1.920Mbps)		48khz/16bit(6.144Mbps) 48khz/20bit(7.680Mbps)	8.064 9.600	74 62	
6ch		48khz/16bit(4.608Mbps) 48khz/20bit(5.760Mbps) 48khz/24bit(6.912Mbps) 96khz/16bit(9.216Mbps)		4.608 5.760 6.912 5.216	129 103 86 65	* *
8ch			48khz/16bit(6.144Mbps) 48khz/20bit(7.680Mbps) 48khz/24bit(9.216Mbps)	6.144 7.680 9.216	97 78 65	*

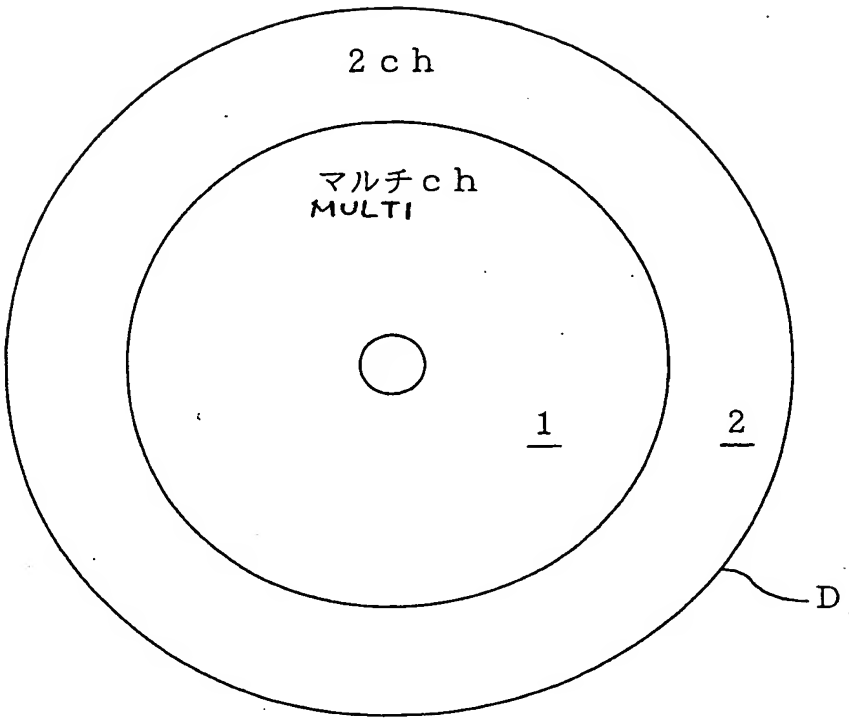
【図20】FIG. 20

2+6CH	2CH	FRONT 3CH	REAR 2CH, LFE 1CH	Mbps	TIME
	48khz/16bit(1.536Mbps)	96khz/16bit(4.608Mbps)	48khz/16bit(2.304Mbps)	8.448	70
	〃	96khz/20bit(5.760Mbps)	48khz/16bit(2.304Mbps)	9.6	62
	48khz/20bit(1.920Mbps)	96khz/16bit(4.608Mbps)	48khz/16bit(2.304Mbps)	8.832	67

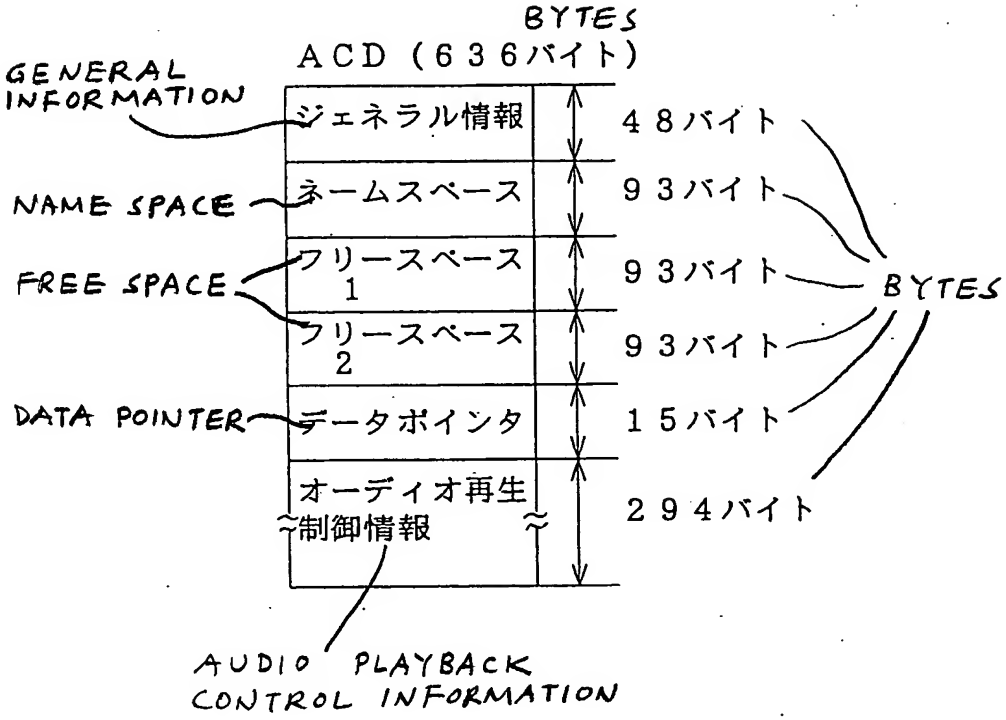
2+5CH	2CH	FRONT 3CH	REAR 2CH	Mbps	TIME
	48khz/16bit(1.536Mbps)	96khz/20bit(5.760Mbps)	48khz/16bit(1.536Mbps)	8.832	67
	48khz/20bit(1.920Mbps)	96khz/20bit(5.760Mbps)	48khz/16bit(1.536Mbps)	9.216	65
	48khz/20bit(1.920Mbps)	96khz/20bit(5.760Mbps)	48khz/20bit(1.920Mbps)	9.6	62

6CH		FRONT 3CH	REAR 2CH, LFE 1CH	Mbps	TIME
		96khz/16bit(4.608Mbps)	48khz/16bit(2.304Mbps)	6.912	86
		96khz/20bit(5.760Mbps)	48khz/16bit(2.304Mbps)	8.064	74
			48khz/20bit(2.880Mbps)	8.64	68
			48khz/24bit(3.456Mbps)	9.216	65
		96khz/24bit(6.912Mbps)	48khz/16bit(2.304Mbps)	9.216	65

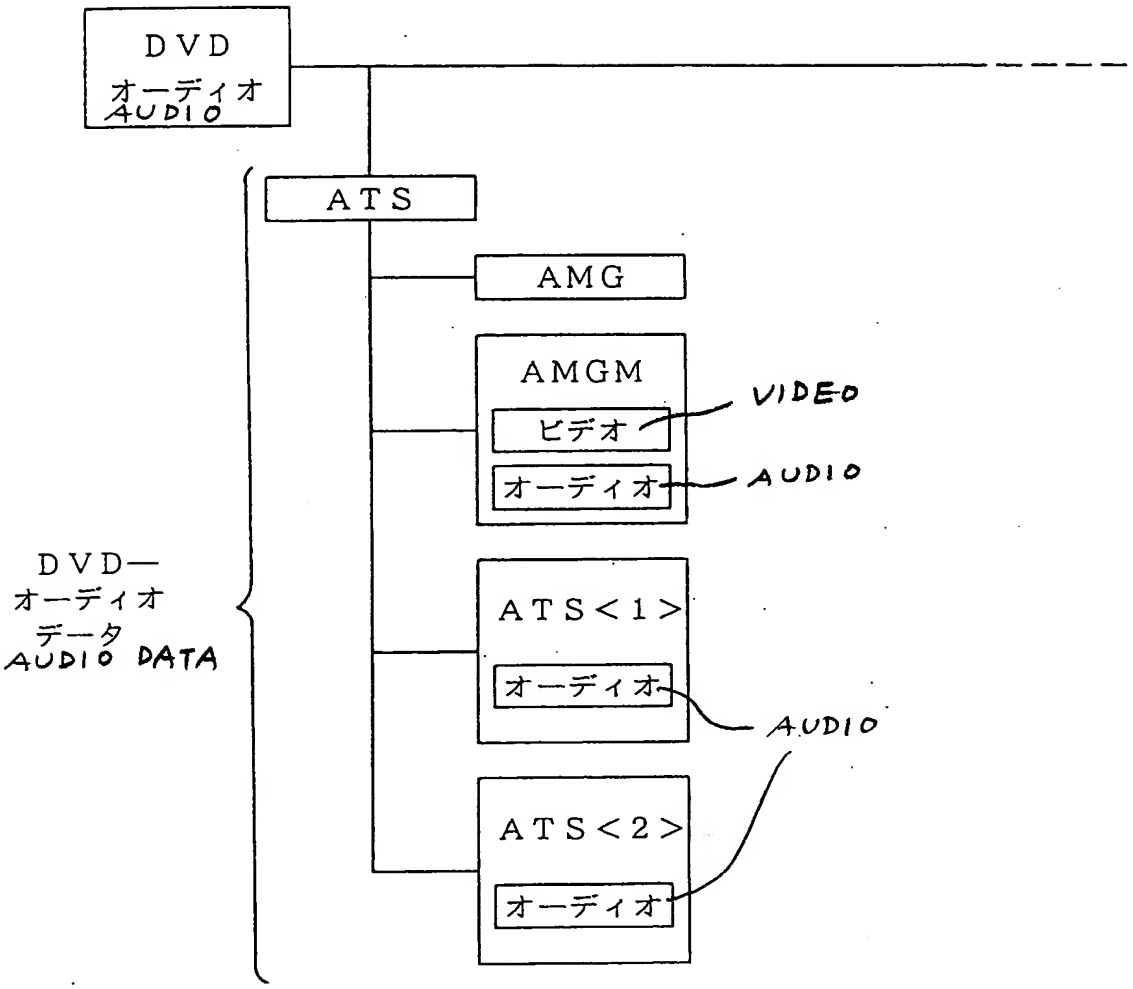
【図21】FIG. 21



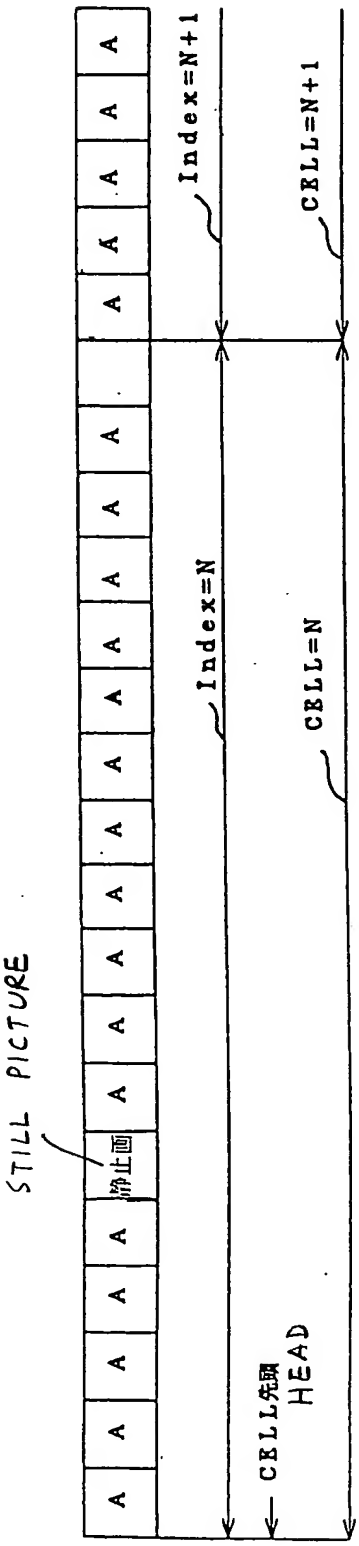
【図２２】ＦＩＧ．２２


BYTES
ACD（６３６バイト）
GENERAL INFORMATION
ジェネラル情報
４８バイト
NAME SPACE
ネームスペース
９３バイト
FREE SPACE
フリースペース 1
９３バイト
BYTES
フリースペース 2
９３バイト
DATA POINTER
データポインタ
１５バイト
オーディオ再生制御情報
２９４バイト
AUDIO PLAYBACK CONTROL INFORMATION

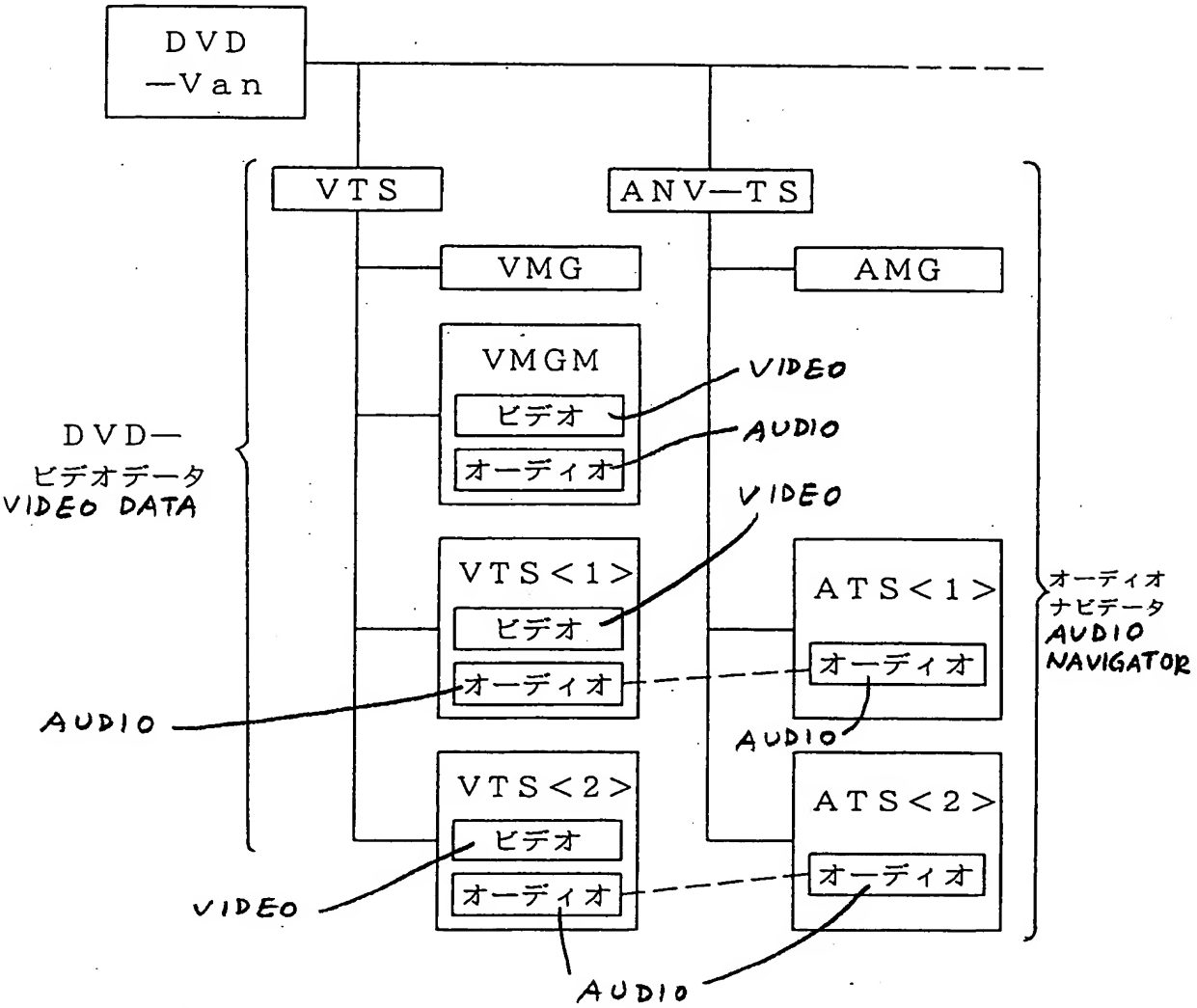
【図２３】FIG. 23


DVD
オーディオ
AUDIO
ATS
AMG
AMGM
ビデオ
VIDEO
オーディオ
AUDIO
DVD—
オーディオ
データ
AUDIO DATA
ATS＜1＞
オーディオ
AUDIO
ATS＜2＞
オーディオ

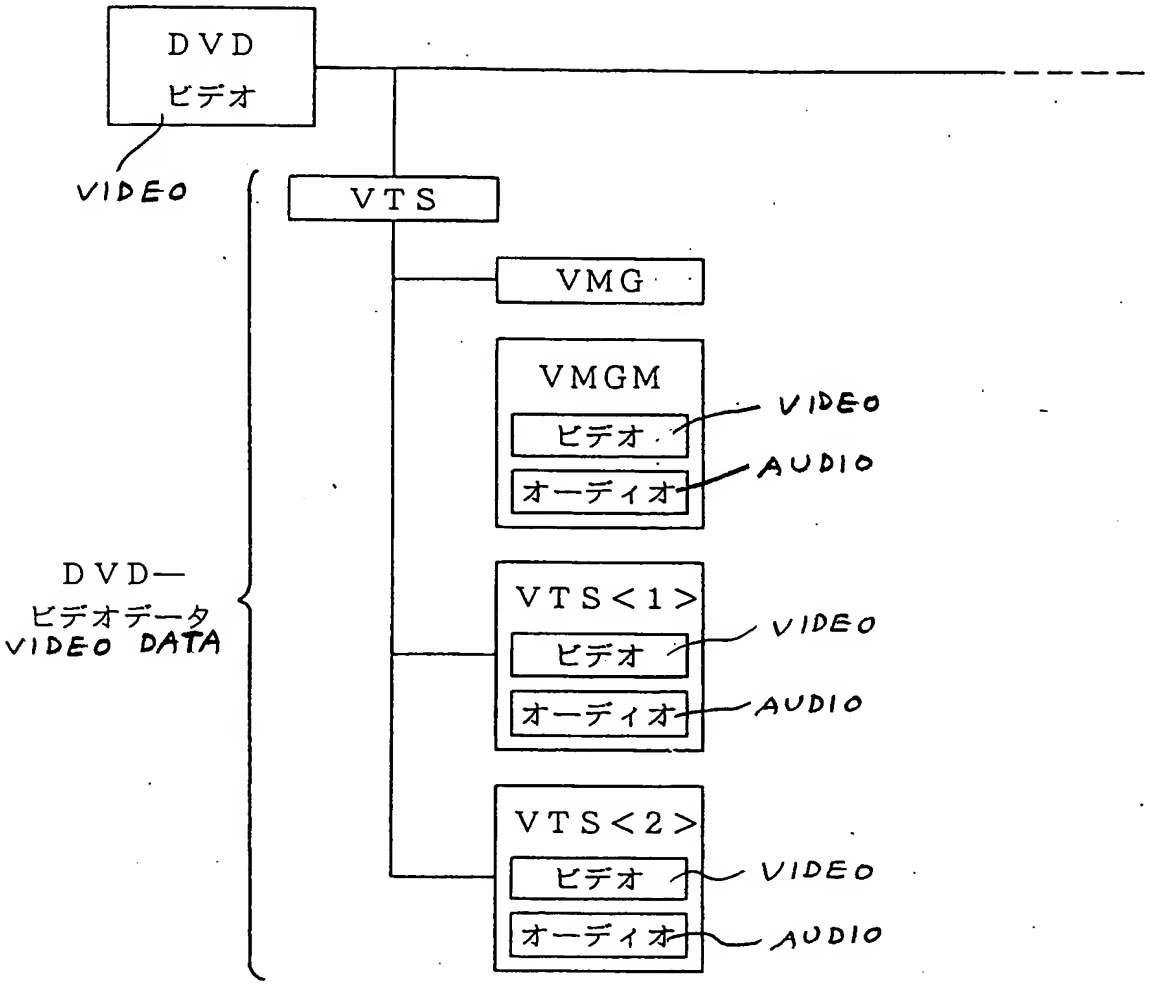
【図２４】ＦＩＧ．２４


A
静止画
STILL PICTURE
CELL先頭
HEAD
Index=N
Index=N+1
CELL=N
CELL=N+1

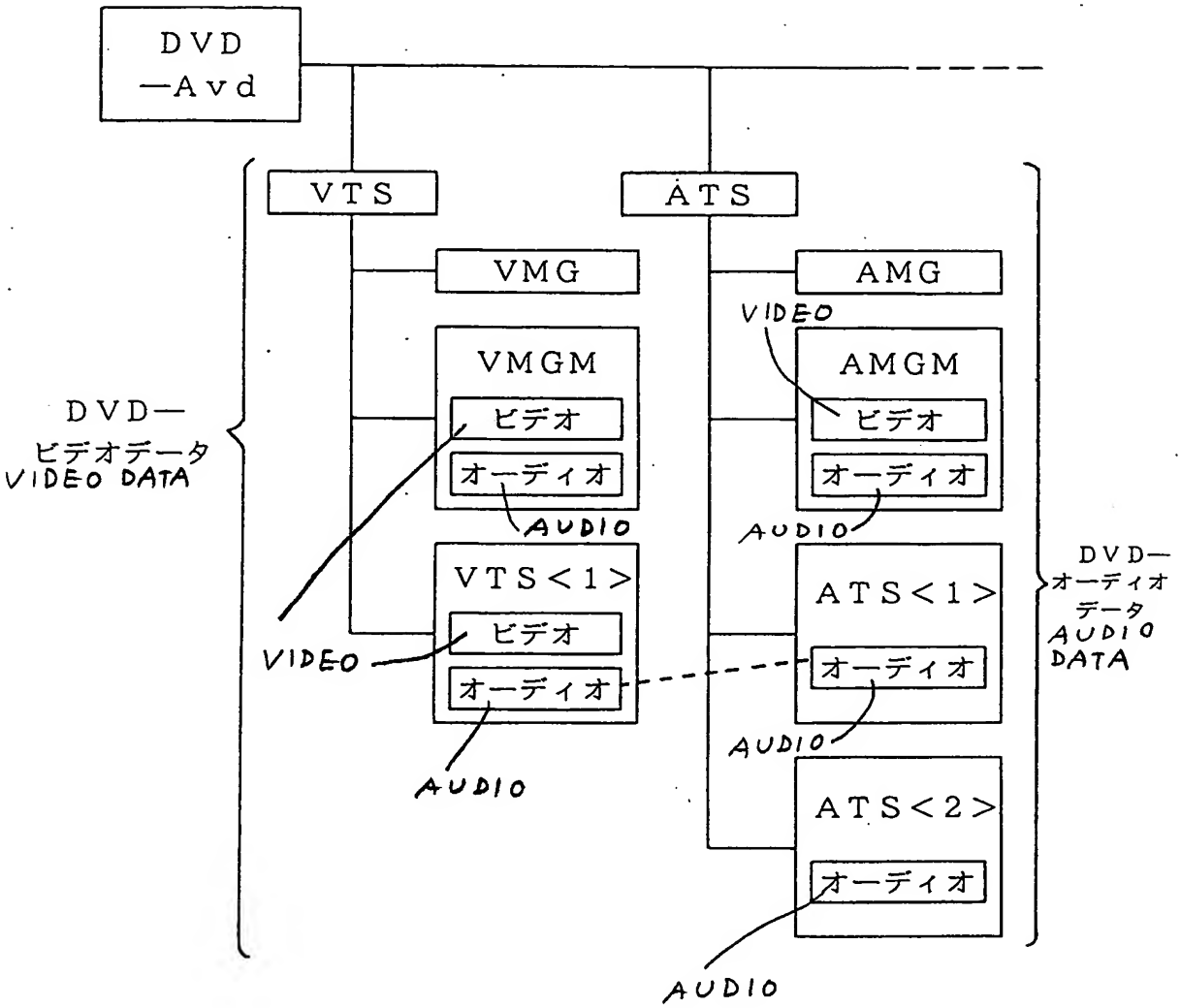
【図２５】FIG. 25


DVD
—Van
VTS
ANV—TS
VMG
AMG
VMGM
ビデオ
オーディオ
VIDEO
AUDIO
DVD—
ビデオデータ
VIDEO DATA
VTS＜1＞
ビデオ
オーディオ
ATS＜1＞
オーディオ
VTS＜2＞
ビデオ
オーディオ
ATS＜2＞
オーディオ
ナビデータ
AUDIO
NAVIGATOR

【図26】FIG. 26


DVD
ビデオ
VIDEO
VTS
VMG
VMGM
ビデオ
オーディオ
VIDEO
AUDIO
DVD—
ビデオデータ
VIDEO DATA
VTS＜1＞
ビデオ
オーディオ
VIDEO
AUDIO
VTS＜2＞
ビデオ
オーディオ
VIDEO
AUDIO

【図27】FIG. 27

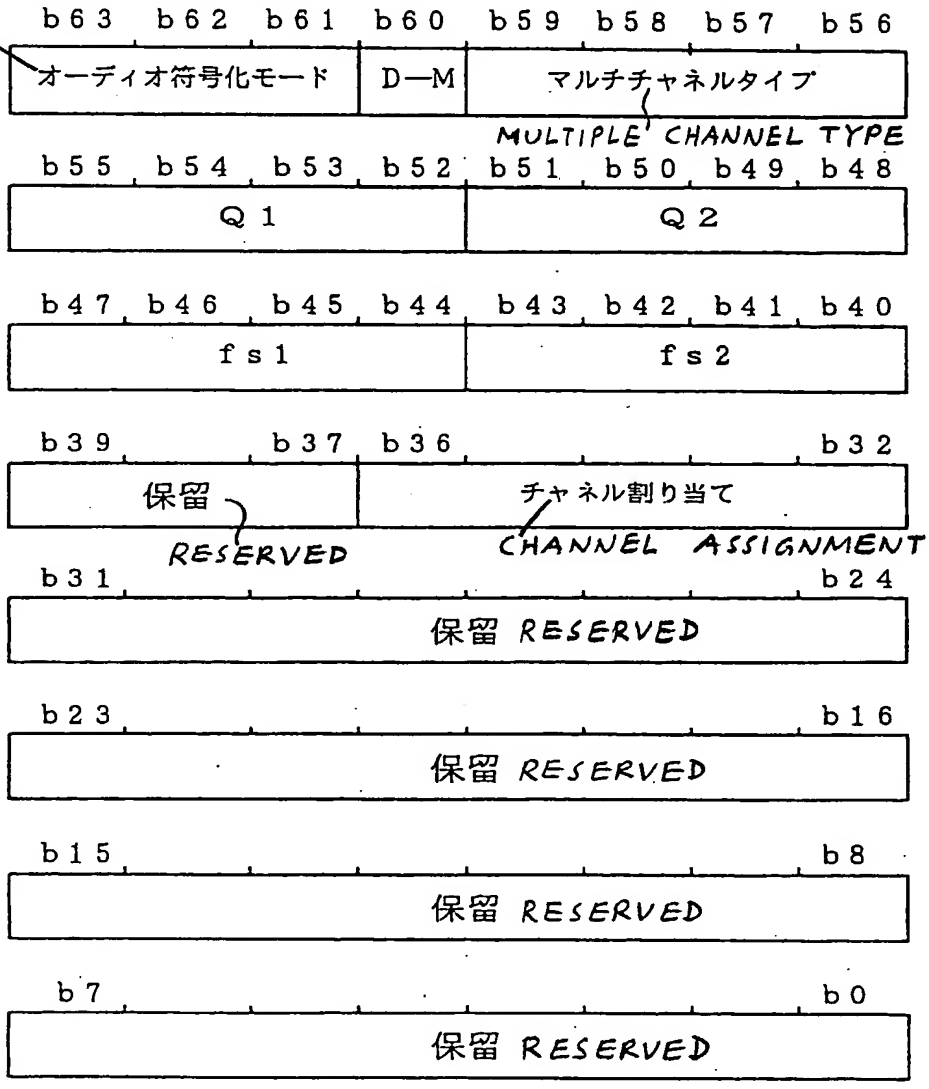

DVD
—Avd
VTS
ATS
VMG
AMG
VMGM
AMGM
ビデオ
オーディオ
VIDEO
AUDIO
VTS＜1＞
ATS＜1＞
ATS＜2＞
DVD—
ビデオデータ
VIDEO DATA
DVD—
オーディオ
データ
AUDIO
DATA

【図28】FIG. 28

AUDIO ONLY TITLE AUDIO OBJECT ATTRIBUTE
(オーディオオンリタイトル・オーディオオブジェクト・アトリビュート)

AOTT—AOB—ATR

AUDIO ENCODING MODE



【図29】FIG. 29

CHANNEL ASSIGNMENT INFORMATION (PATTERN)

CHANNEL STRUCTURES OF GROUPS "1", "2"

CHANNEL NUMBER OF GROUP "1"

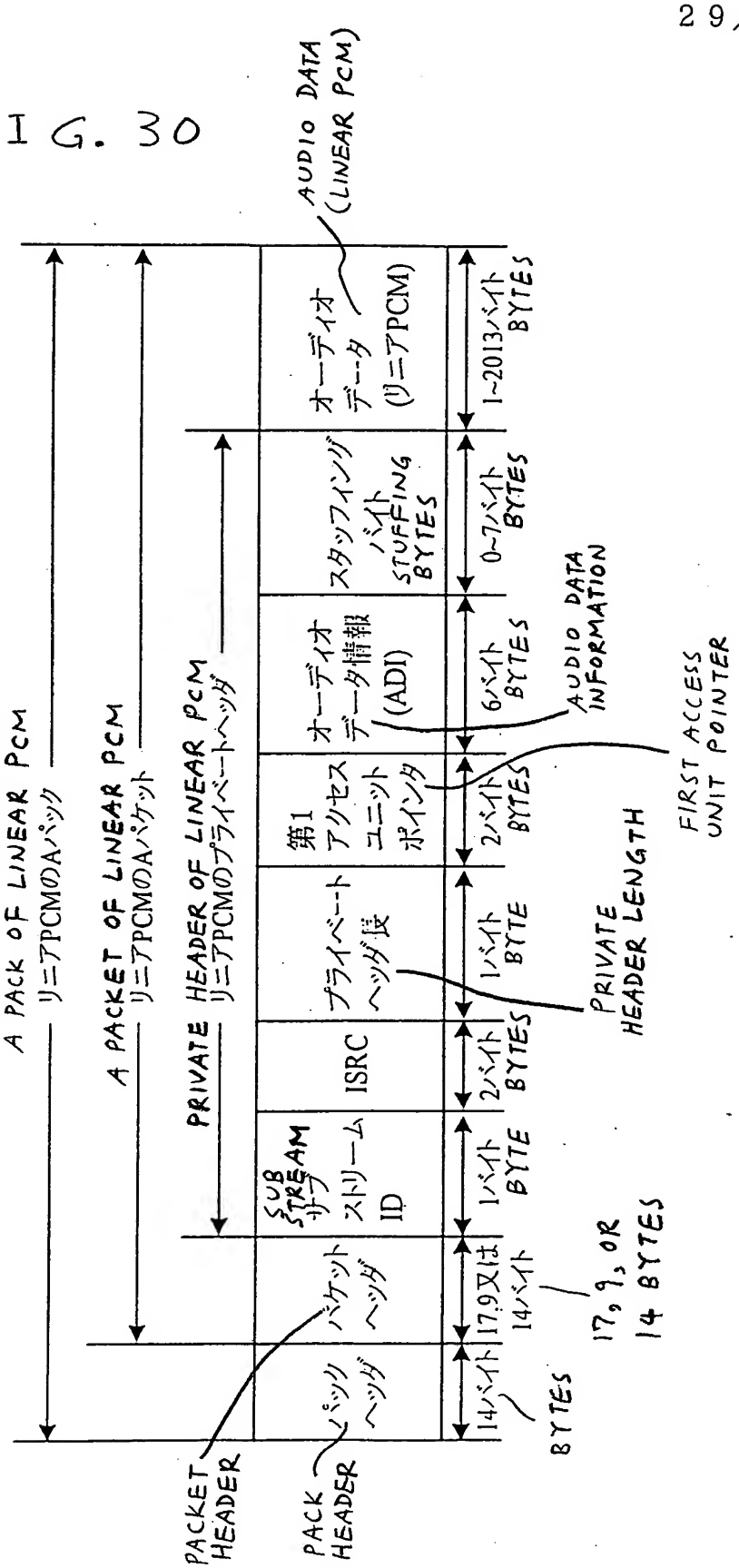
CHANNEL NUMBER OF GROUP "2"

チャネル割当情報(パターン)	グループ「1」「2」のチャネル構造						グループ「1」のチャネル数	グループ「2」のチャネル数
	ACH0	ACH1	ACH2	ACH3	ACH4	ACH5		
00000b	C(mono)	none	none	none	none	none	1	0
00001b	L	R	none	none	none	none	2	0
00010b	Lf	Rf	S	none	none	none	2	1
00011b	Lf	Rf	Ls	Rs	none	none	2	2
00100b	Lf	Rf	LFE	none	none	none	2	1
00101b	Lf	Rf	LFE	S	none	none	2	2
00110b	Lf	Rf	LFE	Ls	Rs	none	2	3
00111b	Lf	Rf	C	none	none	none	2	1
01000b	Lf	Rf	C	S	none	none	2	2
01001b	Lf	Rf	C	Ls	Rs	none	2	3
01010b	Lf	Rf	C	LFE	none	none	2	2
01011b	Lf	Rf	C	LFE	S	none	2	3
01100b	Lf	Rf	C	LFE	Ls	Rs	2	4
01101b	Lf	Rf	C	S	none	none	3	1
01110b	Lf	Rf	C	Ls	Rs	none	3	2
01111b	Lf	Rf	C	LFE	none	none	3	1
10000b	Lf	Rf	C	LFE	S	none	3	2
10001b	Lf	Rf	C	LFE	Ls	Rs	3	3
10010b	Lf	Rf	Ls	Rs	LFE	none	4	1
10011b	Lf	Rf	Ls	Rs	C	none	4	1
10100b	Lf	Rf	Ls	Rs	C	LFE	4	2
その他	保留:RESERVED							

チャネルグループ1　チャネルグループ2

CHANNEL GROUP 1　CHANNEL GROUP 2

【図30】FIG. 30


A PACK OF LINEAR PCM
リニアPCMのAパック
A PACKET OF LINEAR PCM
リニアPCMのAパケット
PRIVATE HEADER OF LINEAR PCM
リニアPCMのプライベートヘッダ
AUDIO DATA (LINEAR PCM)
オーディオデータ (リニアPCM)
1~2013バイト BYTES
スタッフィングバイト STUFFING BYTES
0~7バイト BYTES
オーディオデータ情報 (ADI)
6バイト BYTES
AUDIO DATA INFORMATION
第1アクセスユニットポインタ
2バイト BYTES
FIRST ACCESS UNIT POINTER
プライベートヘッダ長
1バイト BYTE
PRIVATE HEADER LENGTH
ISRC
2バイト BYTES
SUB STREAM ストリームID
1バイト BYTE
パケットヘッダ
17,9又は14バイト
17, 9, OR 14 BYTES
パックヘッダ
14バイト
14 BYTES
PACKET HEADER
PACK HEADER

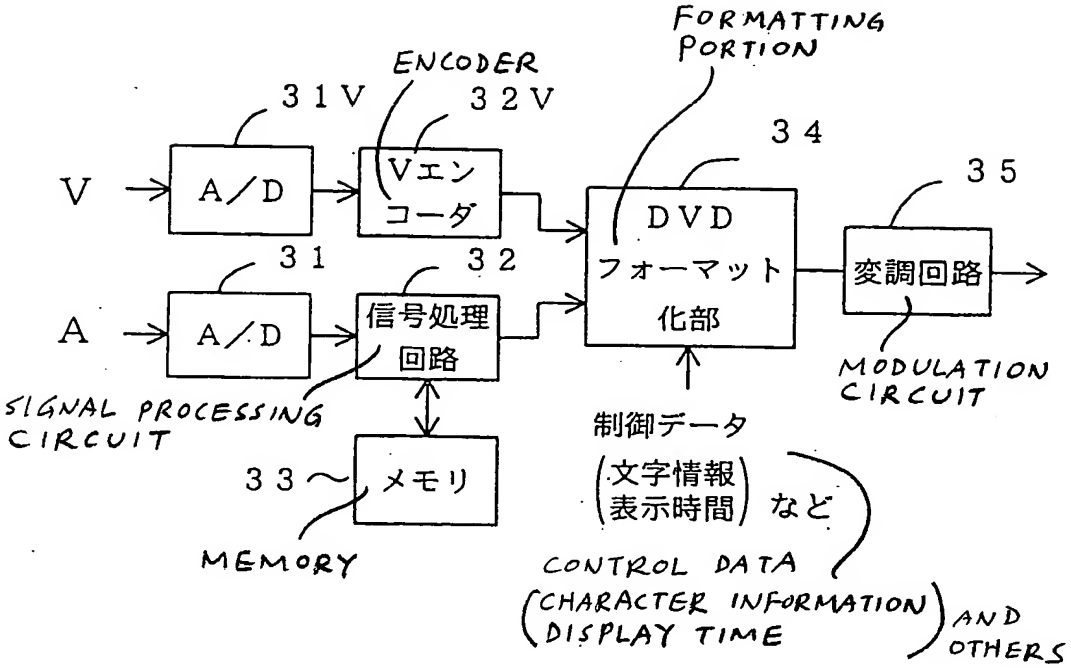
【図31】FIG. 31

PRIVATE HEADER OF LINEAR PCMa
リニアPCMaのプライベートヘッダ

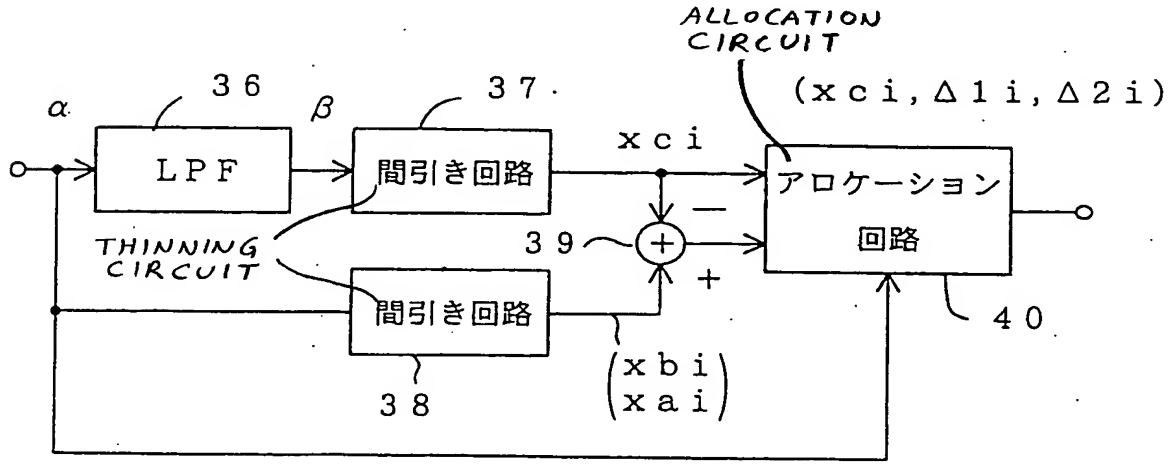
フィールド FIELD	ビット数 BIT NUMBER	バイト数 BYTE NUMBER
サブストリームID SUB STREAM	8	1
保留 RESERVED	4	2
ISRC番号 NUMBER	4	
ISRCデータ DATA	8	
プライベートヘッダ長 PRIVATE HEADER LENGTH	8	1
第1アクセスユニットポインタ FIRST ACCESS UNIT POINTER	16	2
オーディオ・エンファシス・フラグ AUDIO EMPHASIS FLAG	1	1
保留 RESERVED	1	
保留 RESERVED	2	
ダウンミックスコード DOWN MIX CODE	4	
量子化ワード長1 QUANTIZATION WORD LENGTH	4	1
量子化ワード長2 QUANTIZATION WORD LENGTH	4	
オーディオ・サンプリング周波数fs1 AUDIO SAMPLING FREQUENCY	4	1
オーディオ・サンプリング周波数fs2	4	
保留 RESERVED	4	1
マルチチャネルタイプ MULTIPLE CHANNEL TYPE	4	
保留 RESERVED	3	1
チャネル割り当て CHANNEL ASSIGNMENT	5	
ダイナミックレンジ制御 DYNAMIC RANGE CONTROL	8	1
スタッフィングバイト STUFFING BYTES	—	0～7

ADI

【図32】FIG. 32



【図33】FIG. 33



【図34】FIG. 34

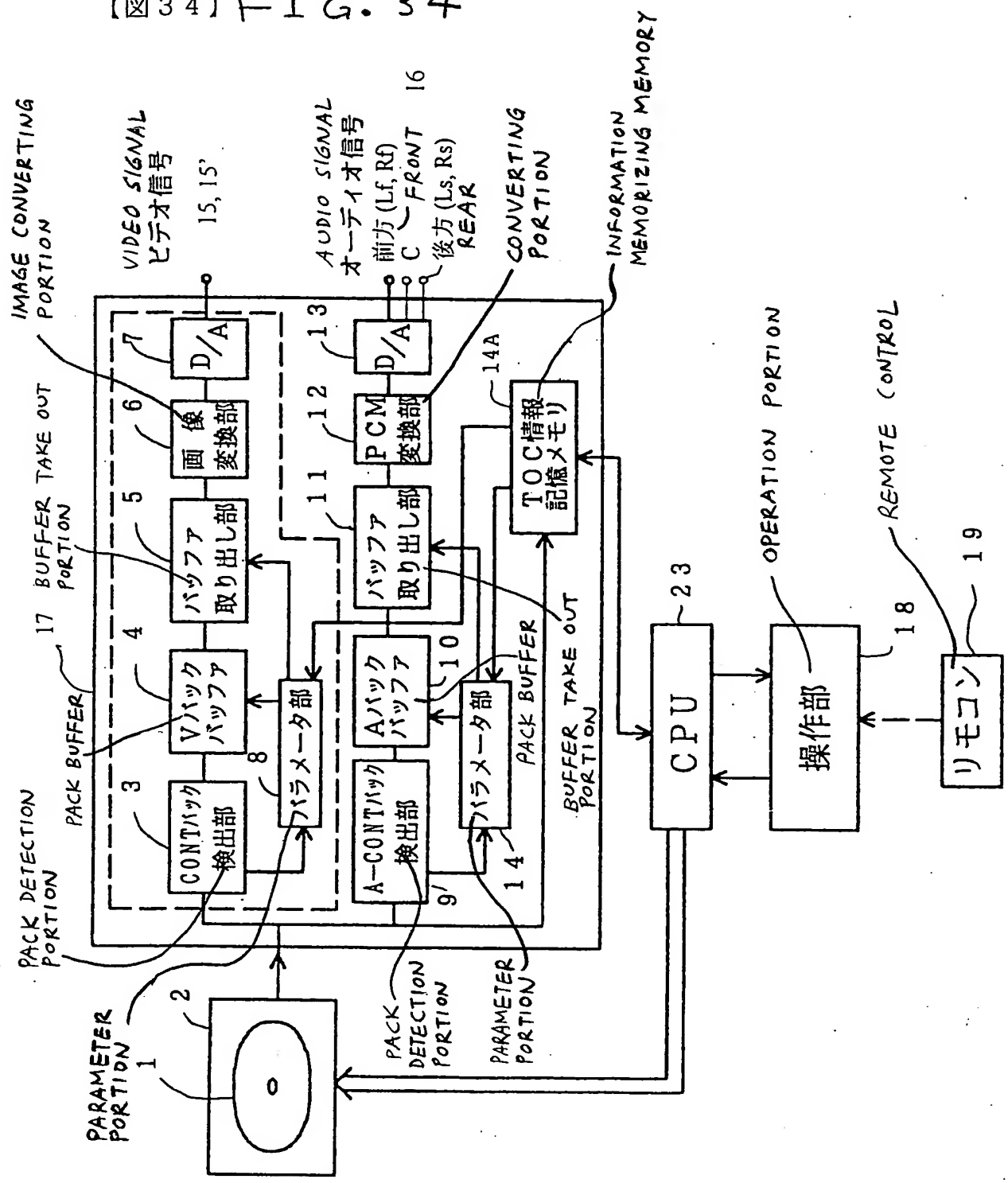
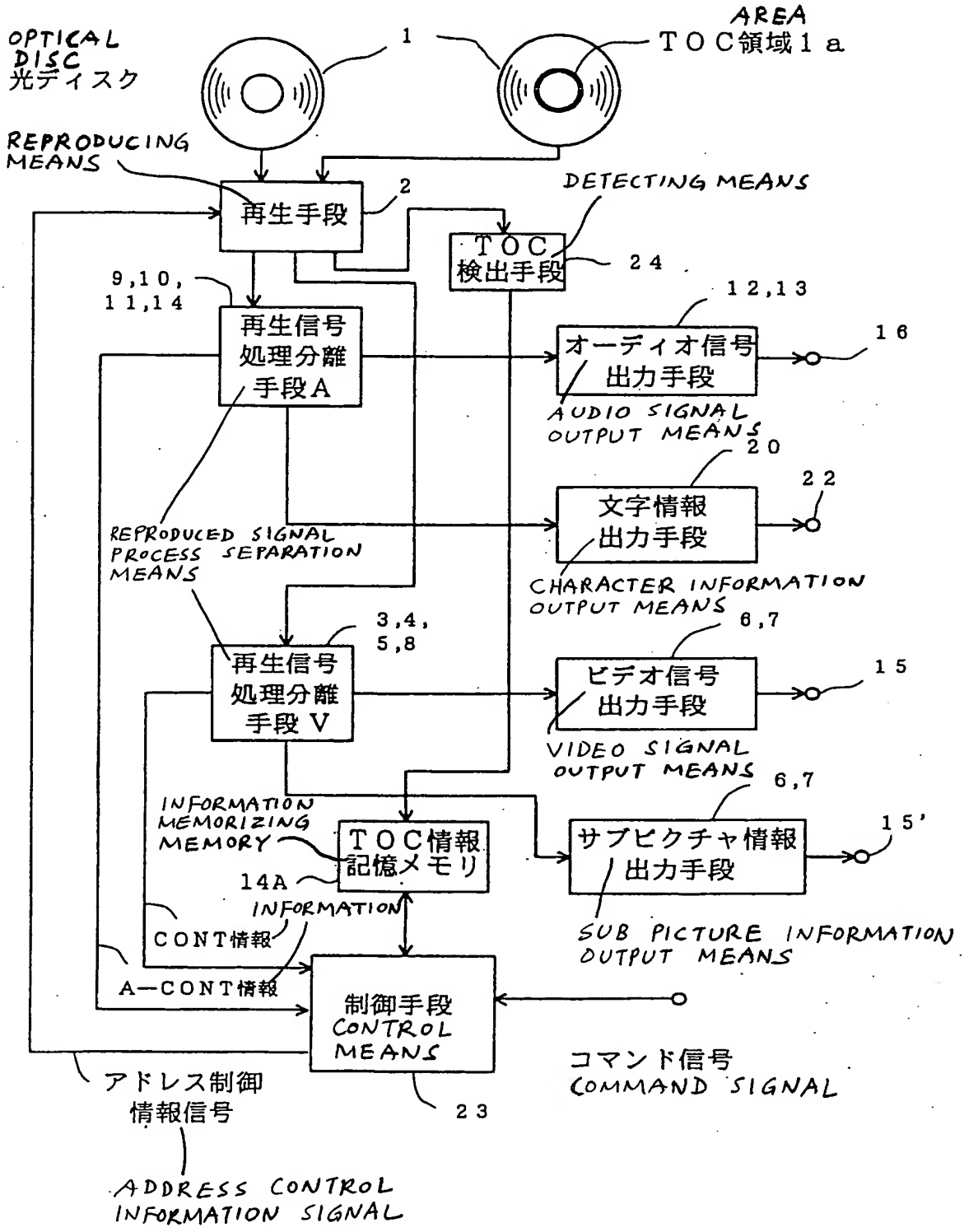


IMAGE CONVERTING PORTION
VIDEO SIGNAL
ビデオ信号
15, 15'
AUDIO SIGNAL
オーディオ信号
前方 (Lf, Rf)
C FRONT
後方 (Ls, Rs)
REAR
16
CONVERTING PORTION
INFORMATION MEMORIZING MEMORY
17 BUFFER TAKE OUT PORTION
PACK BUFFER
D/A
画像変換部
バッファ取り出し部
PCM変換部
TOC情報記憶メモリ
Vパックバッファ
Aパックバッファ
CONTパック検出部
A-CONTパック検出部
パラメータ部
PACK DETECTION PORTION
PARAMETER PORTION
PACK BUFFER
BUFFER TAKE OUT PORTION
CPU
OPERATION PORTION
操作部
REMOTE CONTROL
リモコン
18
19
23

【図35】


OPTICAL DISC
光ディスク
1
AREA
TOC領域1a
REPRODUCING MEANS
再生手段
2
DETECTING MEANS
TOC検出手段
24
9,10,11,14
再生信号処理分離手段A
12,13
オーディオ信号出力手段
16
AUDIO SIGNAL OUTPUT MEANS
20
22
文字情報出力手段
REPRODUCED SIGNAL PROCESS SEPARATION MEANS
CHARACTER INFORMATION OUTPUT MEANS
3,4,5,8
再生信号処理分離手段V
6,7
ビデオ信号出力手段
15
VIDEO SIGNAL OUTPUT MEANS
INFORMATION MEMORIZING MEMORY
TOC情報記憶メモリ
14A
INFORMATION
6,7
サブピクチャ情報出力手段
15'
SUB PICTURE INFORMATION OUTPUT MEANS
CONT情報
A—CONT情報
制御手段 CONTROL MEANS
23
コマンド信号 COMMAND SIGNAL
アドレス制御情報信号
ADDRESS CONTROL INFORMATION SIGNAL

【図36】FIG. 36

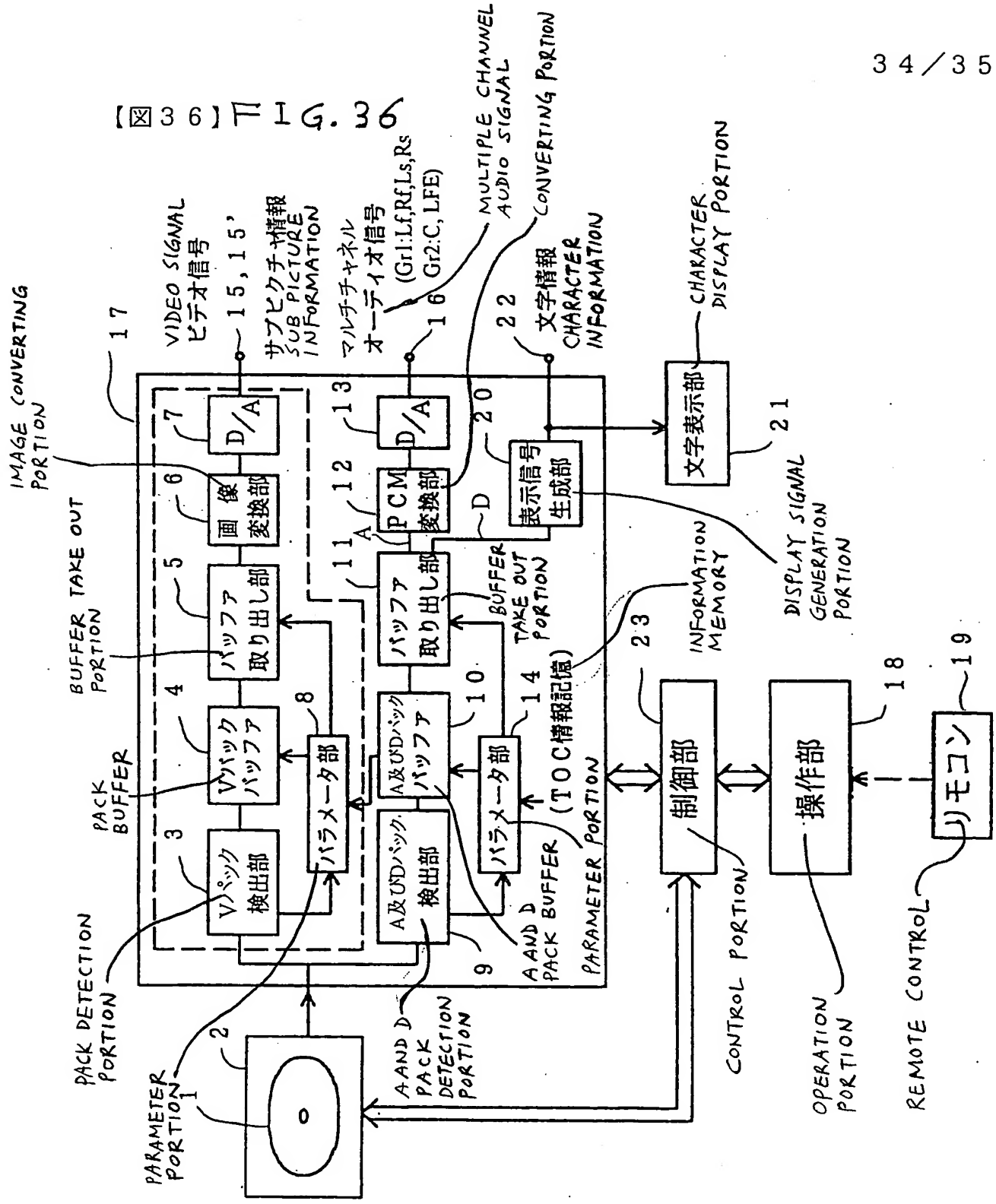
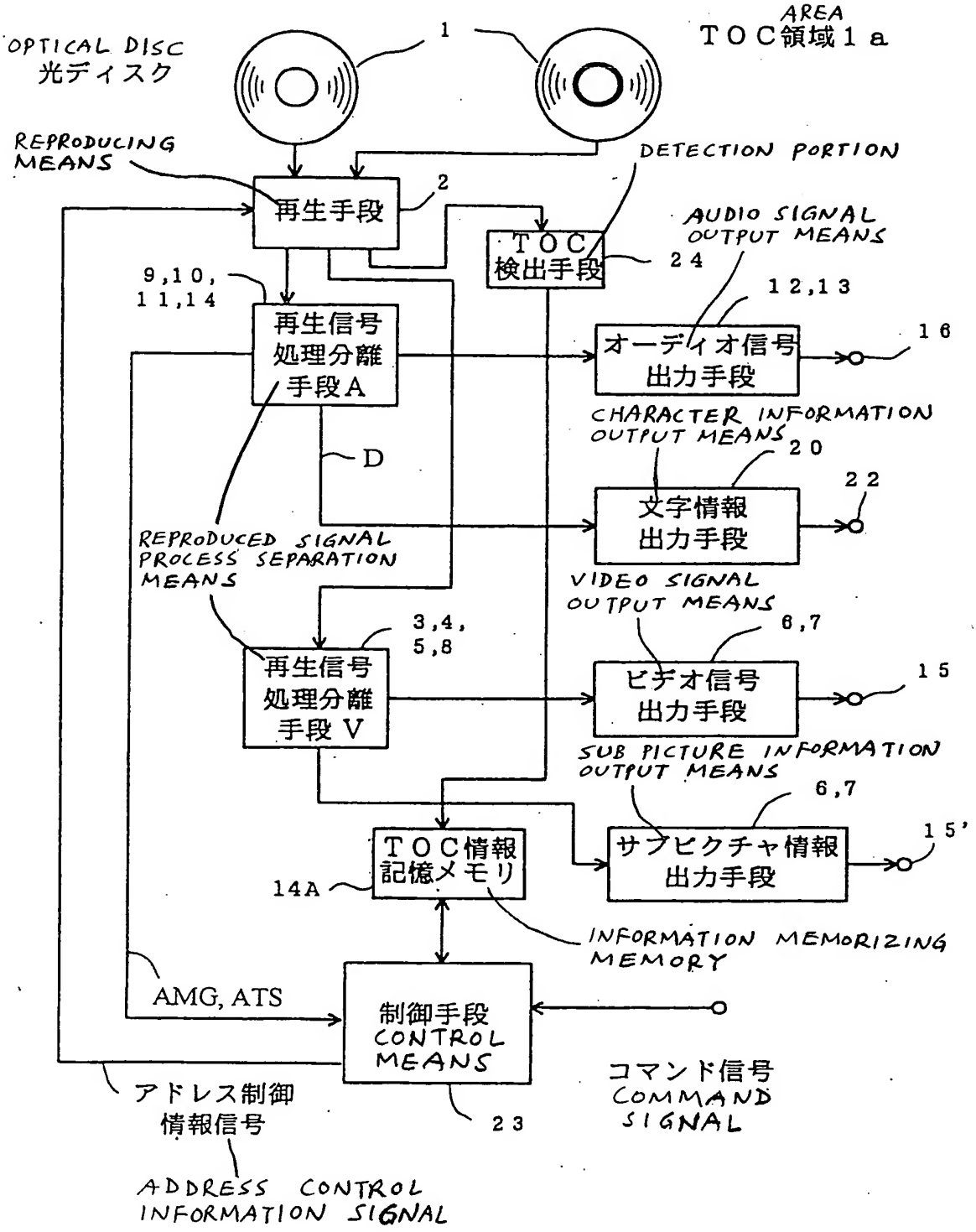


IMAGE CONVERTING PORTION
17
VIDEO SIGNAL
ビデオ信号
15, 15'
サブピクチャ情報
SUB PICTURE INFORMATION
マルチチャネル
オーディオ信号
(Gr1:Lf,Rf,Ls,Rs
Gr2:C, LFE)
16
MULTIPLE CHANNEL AUDIO SIGNAL
CONVERTING PORTION
22
文字情報
CHARACTER INFORMATION
CHARACTER DISPLAY PORTION
D/A
7
13
画像変換部
6
PCM変換部
12
20
表示信号生成部
文字表示部
21
BUFFER TAKE OUT PORTION
バッファ取り出し部
5
11
BUFFER TAKE OUT PORTION
DISPLAY SIGNAL GENERATION PORTION
PACK BUFFER
Vパックバッファ
4
A及びDパックバッファ
10
INFORMATION MEMORY
23
Vパック検出部
3
パラメータ部
8
14
(TOC情報記憶)
制御部
操作部
18
リモコン
19
A AND D PACK BUFFER
9
PARAMETER PORTION
A AND D PACK DETECTION PORTION
PACK DETECTION PORTION
CONTROL PORTION
OPERATION PORTION
REMOTE CONTROL
PARAMETER PORTION
1
2
0

【図３７】FIG. 37


OPTICAL DISC
光ディスク
1
AREA
ＴＯＣ領域１ａ
REPRODUCING MEANS
再生手段
2
DETECTION PORTION
ＴＯＣ検出手段
24
AUDIO SIGNAL OUTPUT MEANS
12,13
9,10,11,14
再生信号処理分離手段Ａ
オーディオ信号出力手段
16
CHARACTER INFORMATION OUTPUT MEANS
20
22
D
文字情報出力手段
REPRODUCED SIGNAL PROCESS SEPARATION MEANS
VIDEO SIGNAL OUTPUT MEANS
3,4,5,8
6,7
再生信号処理分離手段Ｖ
ビデオ信号出力手段
15
SUB PICTURE INFORMATION OUTPUT MEANS
6,7
15'
ＴＯＣ情報記憶メモリ
14A
サブピクチャ情報出力手段
INFORMATION MEMORIZING MEMORY
AMG, ATS
制御手段 CONTROL MEANS
コマンド信号 COMMAND SIGNAL
アドレス制御情報信号
ADDRESS CONTROL INFORMATION SIGNAL
23

10-18013

[DOCUMENT NAME] Abstract

[ABSTRACT]

[Task] It is to enable a sound recording person side to implement sound recording for an approximately constant recording time such that a recording time and a tone quality of an audio signal will be different.

[Solving Means]

An audio pack is loaded with a digital audio signal of each audio title set (ATS) which results from sampling at a sampling frequency varying from channel to channel of multiple channels, and quantization with a different quantization bit number. For example, 2 channel stereophonic signals which are played back by a CD player are assigned to (audio stream) AST#0. Among 6 channels played back by a DVD audio disc, 3 channel front signals are assigned to AST#1, and 2 channel rear signals and a 1 channel LFE signal are assigned to AST#2. An AST attribute table is loaded with the quantization bit number and the sampling frequency of the stereophonic 2 channels of each ATS. An ATS-AST-attribute table is loaded with the quantization bit number and the sampling frequency of each ATS.

[Selected Drawing] Fig. 10

【Document Name】 Office Correction Data

【Corrected Document】 Patent Application

<Recognized Information・Additional Information>

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1. Date of Change August 8, 1990

[Reason for Change] For New Registration

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